

13
511
5

PROCEEDINGS

Staten Island Institute of Arts and Sciences



THE MOON OUR NEAREST NEIGHBOR IN SPACE

by HANS J. BEHM

Contents

Introduction

Early Concepts and the Invention of the Telescope

Major Lunar Features

Impact Craters or Volcanoes?

Maria—Lava or Dust?

Lunar Fracture Structures

Lunar Domes

Lunar Wrinkle Ridges

The First Successful Unmanned Probes: Ranger and Luna 9

The Surveyor Missions

The Orbiter Missions

Summary

References

Glossary

Biographical Note: The Author

(Plate Section follows page 16)

Editor: G. K. Schneider

"Like all sciences, geology is dynamic; it succumbs to new discoveries. Old ideas give way to new concepts as fact gradually replaces guess work."—T. ZUMBERGE (1963)

THE MOON

Our Nearest Neighbor
in Space

Part One

by HANS J. BEHM

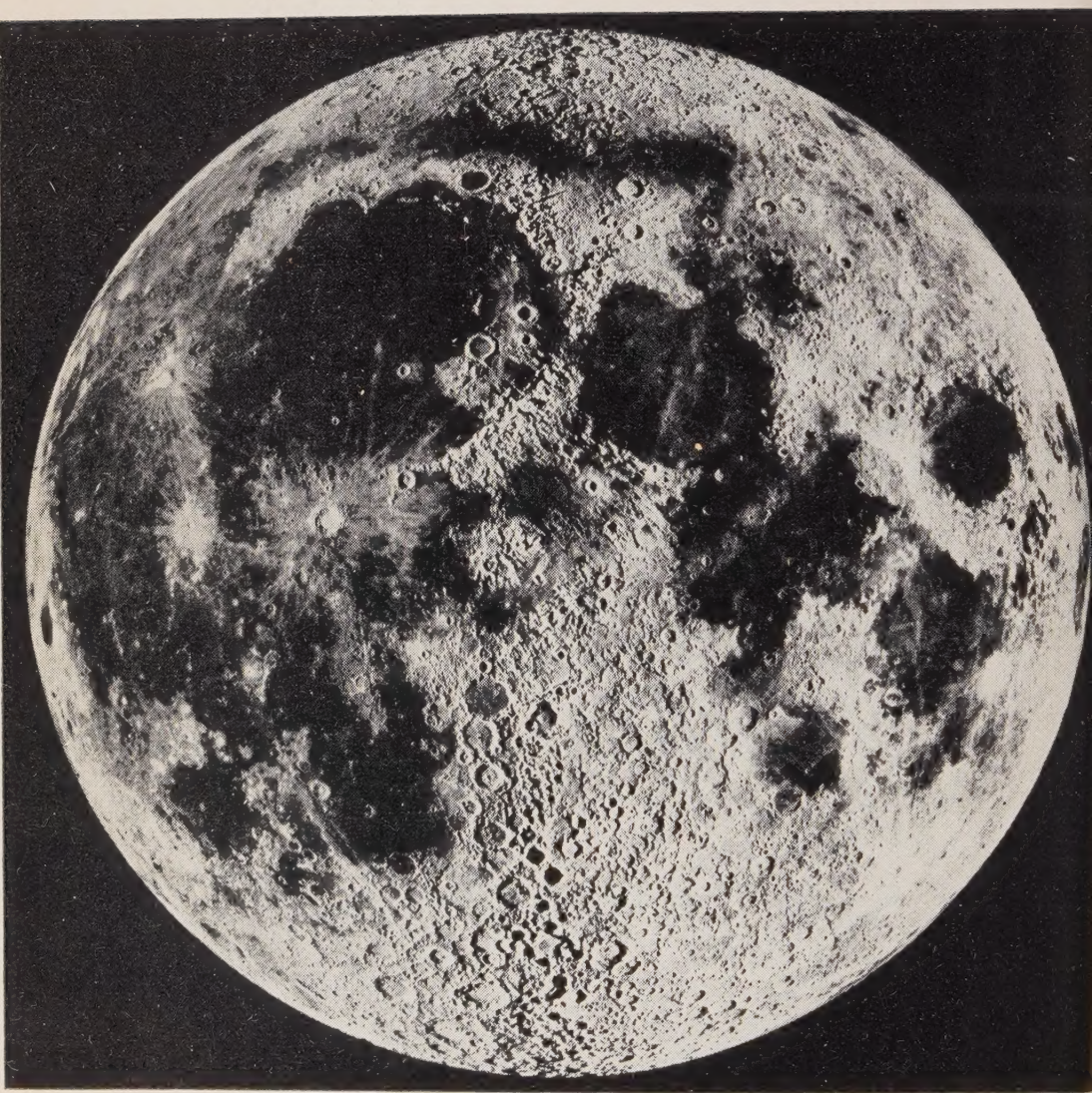


Plate 1. The moon. A composite view of first and last quarters. North is up.
Photo: Lick Observatory, California.

Introduction

1964 marked the 400th anniversary of Galileo Galilei's birth. Galileo, the inventor of the telescope, initiated more detailed lunar surface studies. It was during 1964 that the first unmanned American spacecraft successfully transmitted thousands of close-up views of the moon's surface before it crashed.

Much has been written since Galileo. It was not until the unmanned probes first successfully looked at the moon's surface at close range, that new ideas emerged concerning its evolution. Today, with much new information, little is known about the moon's origin. It will take years of intensive studies before any reasonable conclusions can be drawn. To date, the exploration of the moon's surface has been confined to a very few, small areas. Earth's geologists have spent the last century trying to decipher the history of our planet, but they have hardly scratched its surface. Knowledge concerning the internal structure of the earth remains limited.

Prior to Ranger, lunar studies were confined to telescopic observation. Scientists argued in favor of their pet theories, but their contentions were largely speculative. The origin of lunar craters has been a heated debate. Our unmanned missions have intensified differences of opinion, rather than provided bases for agreement.

This paper composes Part I. Part II will appear in another issue of the Proceedings and will cover the results of the manned landings.

EARLY CONCEPTS AND THE INVENTION OF THE TELESCOPE

The invention of the telescope by Galileo Galilei in 1608 introduced a new era of discovery. Astronomers Herschel, Gauss, Hevel, Halley, Cassini, Laplace, Lagrange, and many others, made significant astrophysical discoveries. Kirchhoff and Bunsen discovered spectral analysis in 1859. This enabled astronomers significantly to advance knowledge concerning the chemical composition of stars and planets. About 480 observatories were in operation in 1920.

Long before the invention of the telescope, the Chinese, under the direction of Emperor Fubi, observed the heavens. The Babylonians, Egyptians, Greeks, and many other nations took an active

part in the study of the sky. Aristarchus measured the distances between the earth, moon, and the sun. Pythagoras suspected that the earth was round, not disc-like. This view contradicted concepts by Thales of Miletus and Anaximander, who pictured the heavens as being a vast crystal dome, on which stars were affixed like nails on a board. Eratosthenes estimated the earth's size, and Hipparchus compiled the first significant star atlas. Ptolemaeus predicted solar and lunar eclipses with great accuracy, but insisted that the earth was the center of the universe. Copernicus caused great consternation among geocentrists when he announced that the sun, and not the earth, was the center of the universe. Kepler, a German mathematician, proclaimed the famous laws of planetary motion. Riemann and Minkowski conceived of a four-dimensional space continuum; and Einstein, who analyzed the data, enunciated the famous theory of relativity.

Prior to Galileo, learned men speculated about the lunar surface. Many suggestions were offered, some more plausible than others. Some believed that the darker areas of the moon, the maria (Lat. *seas*), were large bodies of water similar to those on earth. Pickering (1924), thought that he had seen large swarms of insects. Peal (1886), Hoerbiger (1900), Bivar (1902), Maunder (1904), Fauth (1908), Sellers (1925), Maby and Ellison (1926) thought that ice, snow and glaciers were present on the moon's surface. Voigt (1904) and Beard (1917) claimed to have seen coral reefs. Maby (1926) thought that he had seen patches of vegetation. Weisberger (1942) supposedly saw dust storms on the moon. Last, Ocampo (1949) ascribed lunar craters to thermonuclear bombs.

For ages selenologists speculated about the nature of the moon's surface. About 50,000 craters were recorded in the early 1900's. Nasmyth and Carpenter attributed crater formation to volcanic processes (Fig. 2). Pickering claims to have seen vapor-like trails in some craters, which obscured details in places. The American geologist Spurr (1) went to great pains in describing how the lunar surface had been molded by volcanism. Baldwin (2) analyzed the lunar surface, concluding that most craters were created by infalling meteorites. Chain craters, he asserted, were probably volcanic. The large crater Clavius (Plate 2) has been attributed to meteorites colliding with the lunar surface.

According to Baldwin, the great force with which these bodies struck the moon produced large upwellings of lava, flooding the low plains and partially destroying many older features. Urey also supported the view that most of the moon's craters were due to meteoric impact, and he had little credence in the volcanic hy-

THE MOON — *Physical Data*

DIAMETER 2160 miles
 MASS 1/81 of Earth's mass
 DENSITY 3.3 (water = 1)
 SURFACE GRAVITY 1/6 of Earth's gravity
 VELOCITY OF ESCAPE 1.5 miles per second
 VELOCITY OF MOTION 2287 miles per hour
 (orbital velocity) 3350 feet per second (0.64 mi/sec)

DISTANCE FROM EARTH

MEAN 238,850 miles,
 60 x the Earth's radius
 MAXIMUM 252,000 miles
 (At apogee)
 MINIMUM 225,700 miles
 (At perigee)

PERIOD OF REVOLUTION

SYNODIC 29d. 12h. 44m. 2.8s.
 (Phase to phase)
 SIDEREAL 27d. 7h. 43m. 11.5s.
 (True period)
 ROTATION PERIOD 27d. 7h. 43m.
 11.5s. (About Moon's axis)

Eccentricity of orbit to ecliptic	0.05°
Inclination of orbit to orbit of Earth	5°9′
Inclination of Moon's equator to Moon's orbit	1.5°
ALBEDO (Reflecting Power)	0.07

SURFACE TEMPERATURE

Maximum: 215°F (101.5°C)

Minimum: -300°F (-184.9°C)

Fig. 1

pothesis. Gold attributed the darker maria to the deposition of vast quantities of fine dust produced by the erosion of the highlands. This dust, he explained, would be very thick in places, posing a threat to landing vehicles. The dust appeared darker because of exposure to radiation, and the highlands were lighter because erosion kept exposing fresh bedrock. Hence, the highlands were considered to be safer for landing and basing operations. Green (3) likened lunar craters to calderas on earth, attributing most lunar surface phenomena to volcanism.

IMPACT CRATERS OR VOLCANOES?

The earth is dynamic, mobile, and everchanging. The moon, because of its small mass, is probably homogeneous throughout and, therefore, does not possess a mantle and a core. Large-scale lunar differentiation processes would be needed to initiate layering. On earth, it is believed, differentiation brought about extensive changes,

the lighter rocks forming the crust, and the heavier constituents sinking to the center. As a result, the earth has a well-defined crust, a mantle, and a core.

What initiates volcanism? Radioactivity? Stresses within the earth's crust and mantle with resultant temperature rise? We really do not know all the answers. On earth, volcanoes are associated with major fractures, which represent weaknesses within the earth's crust. The Circum-Pacific Belt is such a zone. Other active seismic and volcanic zones are present in mid-ocean ridges. The Mid-Atlantic Ridge is such a structure, an enormous mountain chain that stretches from the Arctic Ocean, through Iceland, all along the middle of the Atlantic Basin, swings around Africa, continues in the Indian Ocean, finally to disappear below the Red Sea. These ridges are the result of everchanging, crustal upheavals, and are due to tensional forces brought about by mantle convection currents, according to some geologists. There is no concrete evidence for crustal upheaval on the moon, that is, by endogenetic processes. And yet, many selenologists ascribed lunar craters to volcanism. The reason that the volcanic hypothesis gained such popularity among many geologists is due largely to the works by Nasmyth and Carpenter, astronomers, and Spurr, a geologist. One of the earliest proponents of impact was von Bieberstein (1802). Gruithuisen, a German scientist, also favored the impact hypothesis. But it was the American geologist, Gilbert, who laid the foundations for the meteoric school. One of the most convincing arguments in favor of impact, stressed by Gilbert, is that the bottom of lunar craters is deeply depressed below the general level of the surrounding plain. On earth, Gilbert explained, volcanic vents and calderas are located on mountains, well above the general level of the surrounding terrain. (Plates 3a and 3b). These fundamental and very significant observations made a deep impression on Nobel Laureate Urey and Baldwin, both adherents of the meteoritic school. Another argument in support of impact is that most lunar craters are randomly distributed. There is a special class of craters, the chain craters, which are generally aligned along fractures, or zones of weakness in the lunar crust. But no one is absolutely sure whether they are truly volcanic. Some chain craters appear to have been formed by loose material seeping into hollows below. Perhaps a large impact produced enough throwout material that landed on some fractures, part of which seeped into cavities below. Thus, chains of craters were produced, giving at first the impression that they had been formed by volcanism. The only features that appear to be of volcanic origin are the lunar domes. Most

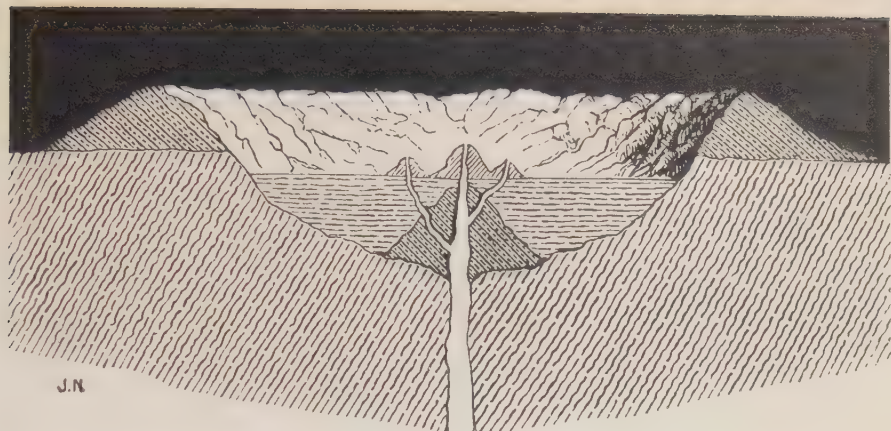


Fig. 2. A volcanic lunar crater. (After Nasmyth and Carpenter, *The Moon*)

have a central vent, but some appear to lack this feature. Volcanic lurain may be present south of Tobias Mayer, in Oceanus Procellarum, and the Marius Hills. Further confirmation of this view is needed.

In earlier days lunar mountains were generally depicted as having very acute summits with steep and precipitous walls, with or without jagged features (Plate 4). Later measurements have shown that the rims of large craters are gently rounded, and their slopes are generally much less than originally assumed (a 5 to 10 degree average slope in the most rugged areas on the moon). Radar studies had predicted a gently rolling and smooth lunar surface on the decimeter and meter scale. Due to the greater curvature on the moon, an observer standing in the center of one of the larger craters would fail to see its rampart. In general, smaller craters have steeper slopes. The slopes of the inner walls of craters are generally steeper than their flanks. The larger craters are typically terraced within. As a rule, impact craters are depressed below the level of the surrounding surface, smaller craters being cup-shaped (Plate 5), larger craters often having flat floors with or without central peaks (Plate 6). Green likened lunar craters to calderas on earth. These earthly features are either the result of collapse within a volcanic cone, probably due to magmatic withdrawal, or are due to explosion. The difference between impact and volcanic craters becomes apparent to anyone when he compares the famous Barringer crater in Arizona with, let us say, Oregon's famous Crater Lake. In the first case the crater is cup-shaped and deeply depressed below the level of the surrounding terrain. No known volcanic material is associated with Arizona's crater (Plate 7). Crater Lake is located

high up on a volcanic mountain. Moreover, most calderas are not perfectly circular, but somewhat oval in outline. Impact craters are almost always circular in outline. This is due to the explosion that was brought about by high velocity impacts and is independent of the angle at which the impinging body struck the surface. Again, if one were able to scoop up all the material making up the rim of the crater, and to deposit it in its depression, the bottom would be filled. Schroeter made this important observation, referred to as the Schroeter Rule. This argument is valid for younger and undisturbed craters. Some older craters are so degraded and deformed that it would be difficult to make this rule valid. Yet, though their bottoms are partially filled with debris, they are still, in most cases, depressed below the general surrounding surface.

The process of impact by high velocity has been extensively investigated and supported by experimental studies. In the 1940's Baldwin applied mathematics to the problem. In the sixties, Shoemaker, one of the foremost astrogeologists, studied craters produced by nuclear blasts, set off above and below the surface. His studies on the ballistics of impact craters further added to the credence of the meteoritic hypothesis. According to Shoemaker, maar craters most closely resemble some lunar craters. Maar craters are created by violent steam explosions, and are not accompanied by igneous extrusion. Gilbert noted and described this type of crater, stating that the rim material would fill its depression. In his own words, "The maars are still of rarer occurrence, and represent the anti-thetic phase of volcanism. The process of their formation includes no eruption of lava, but merely an explosion of steam. By that explosion a body of rock is broken into fragments and thrown outward. Such of the fragments as descend outside the cavity are heaped about its margin, constituting a rim, which is smooth if the fragments are small and rugged, and irregular if they are large." Furthermore: "They resemble craters of the moon, in that their bottoms are depressed below the general level, and in that the volumes of their rims are approximately equal to the capacities of their cavities. They lack the wreath, the inner terraces, the inner plain, and the central hill. Thus characterized, they differ widely from the lunar craters of medium and maximum size, but they resemble those of smaller size." The presence of such craters on the moon would imply the presence of water at one time. But chemical analyses of specimens brought back to earth by the Apollo missions have shown that water has apparently never been present on the moon, as was thought by some scientists. Maar craters represent a special phase of volcanism on earth.

One of the most unusual observations by Orbiter I was that the moon's highlands might possibly be younger, and not older, than the maria. The walls of the crater Gambart appear smooth, like those of the large crater Alphonsus (Plate 8). This picture suggests that smaller craters at the foot of the rampart within the crater have been partly or completely buried, hence giving the impression that Gambart is younger and not older than the adjacent mare Iurina. The same holds true for the old ghost crater Flamsteed (Plate 14a). The high reflectivity of the walls of some of these very faint ghost craters suggests that there is a difference in composition. Some writers believe the reason the walls are so smooth is that material slumped, hence destroying any superimposed craters. Some investigators feel that ghost craters were perhaps not ancient eroded rims, but volcanic material that escaped to the surface by way of zones of weaknesses in the lunar crust. Some feel the evidence is supported by the fact that many of these unusual craters have nearly pentagonal or hexagonal outlines, but so do many impact craters.

MARIA—LAVA OR DUST?

That the lunar seas or maria were composed of a lava-like or slag-like material was long suspected by a number of scientists. Sytinskaya (4) thought that the uppermost layers might not be lava but a froth produced by constant impact of micrometeoroids. Kuiper (5) and a number of other scientists predicted a porous, lava-like surface, less dense than terrestrial counterparts, and having a lower bearing strength, yet stable enough for manned missions.

The bulk density of the upper layers of the moon had been estimated to be anywhere from 0.1 to 0.5 that of solid rock. The bearing strength for a bulk density of 0.1 to 0.3 would be about 3 to 8 kg/cm².

Loomis of Jet Propulsion Lab concluded that the maria were not composed of basalt but consisted of huge sheets of volcanic ash which attained great thicknesses in places. Kapp (6), on the other hand, thought that there was no surface resembling rock and predicted a lunar surface of low structural strength, having certain characteristics that are unreproducible on earth. This surface, he concluded, looks solid but has a very low density. Radiowaves sent to the moon had been reflected from a so-called hard rock surface far below the visible surface. This led Kapp to conclude that the compressive and tensile strength of the visible layer was extremely low, hence, posing a major hazard to astronauts. Gold (7) made some tentative conclusions regarding Ranger VII photo (Plate 9).

He asserted that the pictures supported his contention that an active erosion process degraded the physical features of the moon. The dust, he said, settled in low places. The Ranger VII pictures, he concluded, show what appears to be a uniform, fine-grained material near the surface and a few meters below. He observed that the craters in the area showed no hint of any transitional stages to a different material below. Gold concluded that the depth of this layer was considerable and was subject to greater compaction with depth.

Gold's dust hypothesis was met with considerable opposition. His suggestion that the maria were great dust bowls several miles deep blanched many space officials. The opposition argued that fine dust and associated debris would settle gradually in cavities between the larger fragments and rock blocks, filling the upper layers but leaving cavities unfilled below. The amount of eroded material, many scientists thought, would be too small to form layers of considerable depth over the entire surface of the maria. Even if capable of movement, this dust would have been trapped in the valleys, fractures, and other low places and would not move great distances over the lunar surface.

Markov (8) reasoned that a deep dust layer could not be present, because the faults and fractures with steep sides should have been buried. Barabashov (9) thought that the moon's surface was covered by some tuff-like material, largely fragmented, with a grain size from 3 to 10 mm. He argued that the moon could not be covered by a very fine dust because it could not match the observed properties of reflection of light obtained from laboratory control samples. It should be added at this point that a number of investigators used rocks and soils, studied their optical properties, and attempted to match them with the lunar surface. Rostoker (10) thought that major impacts would produce large quantities of very coarse rubble, but these events have occurred infrequently. The majority of impacting bodies are micrometeoroids. Hence, a fine dust would be produced, which would be deposited as a thin blanket over coarse rubble and bedrock. However, it would not be easy to estimate the actual thickness of the dust layer. No one could even guess as to what lay immediately below the surface. Rostoker argued that possible mechanisms of fragmentation such as meteoroid impact, led people to speculate that a layer of fine dust would not be very thick. And yet, he explained, there was no information refuting estimated thicknesses of tens of hundreds of feet in places. He concluded that the depth of dust was a function of the number of large meteoroids penetrating the surface, exposing rubble and bedrock to

further pulverization by impinging micrometeoroids. Oepik (11) thought that each meteor impact would lead to an explosion that produced an enormous amount of loose material, much of which would settle back on the surface. The rubble and dust produced would be of local origin. The unequal distribution of material was used to explain the different reflectivity of the lunar highlands and the maria. He concluded that the presence of dust in the maria did not preclude their possible nature as lava plains; indeed, the solidified lava was probably hidden beneath the dust.

Many investigators believed that many areas on the moon had been flooded or submerged in lava. This appeared to be the case in Oceanus Procellarum and Mare Tranquillitatis. Baldwin, a meteorist, noted many so-called submerged features and lava-filled craters, notably Ptolemaeus and Alphonsus. He speculated that the lavas invading the plains seeped into many of the nearby craters, forming stagnant pools, which later solidified. According to Spurr, a volcanologist, lava-flooding could be seen south of Lansberg, in the southern half of a largely flooded pre-mare crater some 50 miles in diameter.

Many craters appeared to be severely eroded, some showed little change. The large crater Archimedes appeared to be extensively flooded, and so did Plato in Mare Imbrium. The crater Wallace appears to be completely submerged in lava, and only a trace of its rampart emerges from the surface of the plain. Many craters such as Fra Mauro, Parry, Bonpland, and Guericke also led selenologists to believe that they were submerged in lava. The ghost crater, Lambert R in Mare Imbrium, and craters such as MacLear, Jansen, Jansen R, and Maskelyne F, all located in Mare Tranquillitatis, also show the same condition.

Spurr not only envisioned extensive lava flows and volcanism on the moon's surface, but thought that due to the effects of vacuum, gas bubbles in the lava would greatly inflate and enlarge, producing a honeycombed surface on a scale "foreign to our experience." The unmanned and manned missions have refuted this view. Green, another ardent volcanologist, stated that rough and blocky lava would be common on the moon's surface. Firsoff (12) concluded that the lunar surface consisted of a bubbly, pumice-like rock. O'Keefe and Cameron (13) have suggested that the maria were covered by welded tuffs. Lowman (14) proposed the unique theory that lunar maria owed their origin to lopolithic structures. Walter (15) thought that differentiation processes had molded the lunar surface. According to him, radioactive decay produced the necessary heat to initiate igneous activity, but he questioned widespread rock melting

on the moon. Krejci-Graf (16) has suggested a lava-like surface, with ultrabasics as the chief types of rocks. Gilvarry (17) thought that the lunar surface was earth-like in its early history, with a hydrosphere and an atmosphere. However, due to the low gravity on the moon, both the atmosphere and the hydrosphere eventually dissipated into space. Any evidence of an aqueous environment was subsequently destroyed by meteoroid and micrometeoroid impact. This unusual view provided considerable food for thought. The earth's hydrosphere supposedly evolved as a result of differentiation of the mantle. Hence, if the moon was differentiated, reasoned Gilvarry, water must have been present on the moon in considerable quantities. He attributed the dark coloring of the maria to sedimentary rocks with a high organic content.

LUNAR FRACTURE STRUCTURES

A great number of fractures are present on the moon. Many of these trend northeast-southwest, northwest-southeast, and north-south, and occur both in the maria and the highlands. In places, many rilles, as these features are called, pass into wrinkle ridges by imperceptible gradations. Many are parallel to these ridges: for example, the Hyppalus Rilles and the ridges to the east of Mare Humorum. Even the rilles within the crater Hevelius, located in the western part of Oceanus Procellarum, trend in a similar direction to that of the ridges and rilles to the northwest. Many of these rilles trend northwest in Oceanus Procellarum; they are parallel to smaller crater chains, particularly around the crater Galilaei. Chains of craters also are present between the craters Cavalerius C and F. Many chain craters are intimately associated with some rilles, that is, craterlets are superimposed on fractures, indicating that throwout material from nearby impacts landed on these fractures, and seeped into hollows below.

Structurally, these fractures have been attributed to tectonic forces within the lunar crust by some geologists. The shapes of many craters have been apparently controlled by these fractures, resulting in roughly hexagonal outlines. A cursory glance at Mare Humorum and Mare Crisium shows them to be roughly hexagonal.

Lunar fracture structures have been compared with rift valleys, or grabens, by some geologists (Plate 12). Gravity faulting probably is the chief type of displacement. On earth, rift valleys are associated with domes and plateaus in places. Arching produced tension, rupturing the rocks, causing displacement of the blocks. As a result, a whole block, or series of blocks will be displaced downwards, producing long depressions, or valleys hundreds of miles long. On

earth, volcanic activity is frequently associated with these structures. The fact that many rilles on the moon are closely associated with chain craters, argued some selenologists, is evidence in support of volcanism.

A few investigators believe to have seen horizontal displacement on the moon, but this was questioned by others. Fielder pointed out such an area east of Silberschlag and south of Julius Caesar. The Ariadaeus Rille appears to be fractured and subjected to horizontal displacement.

Many fractures cut across maria and highlands, indicating that they were formed later. Some cross one another. The Orbiter missions brought them out in great detail (Plate 10).

Close-ups of the floor of Alphonsus by Ranger XIV showed that many of the smaller fractures were chain craters, which appeared as simple rilles from earth-based telescopes.

What is the nature of these rilles, and how do they relate to the surface? As stated above, some writers have attributed these features to fracturing of the lunar crust, as a result of tectonic forces or major impacts.

The sinuous rilles have captivated the imagination of many selenologists. A few investigators ascribed these features to fluid processes, either volcanic or aqueous. The Orbiter missions brought them out in great detail (Plate 11).

The Alpine Valley bears a remarkable similarity to canyons on earth (Plate 13). Urey had interpreted it as resulting from a low-grazing bolide that originated during the impact that created Mare Imbrium.

LUNAR DOMES

These features are present in some maria, and have been interpreted by some writers to be inflation mounds produced in a cooling mass of lava. Others believe domes are intrusive igneous bodies such as laccoliths, arching the moon's strata above. On earth, these plutons roughly have a plano-convex or double-convex shape in cross section. However, most are text book idealizations, their actual shape being much more complex.

Spurr (1), in discussing lunar domes, makes frequent reference to these structures as "inflation mounds." Domes with central vents can be seen within the walled plain Grimaldi. Three prominent domes are located on the northwest margin of this crater, their average diameter is 10 to 20 miles. An arcuate chain of domes can be observed near the northern rim of Grimaldi.

Domes are also present west and northwest of the large crater Copernicus, and in Mare Tranquillitatis. Many of these features, which may be seen in Oceanus Procellarum, have been ascribed to lunar igneous activity.

The Orbiters rewarded us with much needed information. A number of scientists thought that these pictures supported their contention that lunar domes are volcanic in origin. Some of the close-up views indeed show what appear to be ash-like flows and prominences. These features, which can be seen in the distance in some of the panoramic views taken by Surveyor 1, have a remarkable similarity to the volcanic domes at the South Sister Complex, Oregon.

A number of these lunar domes have small, central vents, resembling stratovolcanoes on earth. They are particularly well displayed in the panoramic view of the Maris Hills, taken by Orbiter (Plate 15). Distinct flow structures appear to be associated with these domes, similar to lava flows. Additional domes can be seen in Plate 16.

The origin of these domes remains obscure. Further analysis and on-site collection of samples will be necessary before final conclusions can be drawn.

LUNAR WRINKLE RIDGES

The moon's wrinkle ridges are amongst the most enigmatic features. They are located in the moon's maria. Some selenologists have interpreted them to be compression folds. (Plate 17). Their extent is considerable, reaching hundreds of miles in places. Many form very complex branching patterns. Little is known about their structural relationships. Whipple suggested that they were formed on top of lava plains, while the latter were still plastic. Spurr interpreted them to be compression features.

Wrinkle ridges may have evolved in the mare crust, while still plastic. Firsoff pointed out that these ridges show evidence of former flow. He said that the maria must have been plastic at one time, perhaps even semi-liquid. Firsoff defines them as "frozen waves," twisted and branched, with gentle slopes and lack of individualized summits. The height of the largest does not reach 1000 feet above the general surface of the moon. Their slopes do not exceed 5° . One of the outstanding characteristics of a number of these features is that they are in some way related to fracture structures (see preceding section on "Lunar Fracture Structures"). Are these ridges true flexure structures? A few investigators believed that they were compression features due to downwarping of the mare basins, for example, Mare Humorum. The eastern half of this plain shows a series of

2. Clavius, one of the larger craters. A "walled plain," as some geologists have called it. Clavius is located near the moon's south pole. Its diameter is 143 miles, its depth is 12 miles. Note the arcuate chain of smaller impact craters on its floor. This photograph shows detail attainable only to the unmanned probes. North is at the top. Photography by the 200-inch Hale telescope, Mount Palomar.

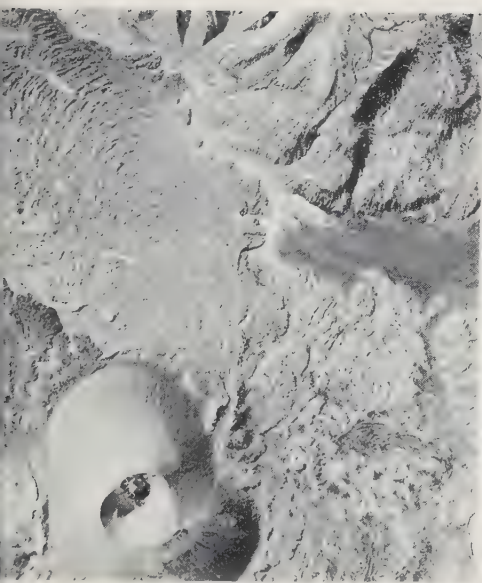


Plate 3a. (Left) An aerial view of Parícutín volcano—a cinder cone. This volcano was born in a cornfield in 1943 in Mexico. It attained a height of 3,000 feet by 1949. Note the location of the vent on top of the cinder cone. Lava flows are clearly delineated. Photo credit: Messrs. Luis Struck, Servicio Aerotécnico, Mexico. *Plate 3b.* (Right) Parícutín volcano, Mexico. Photo credit: Fred Keller, Jr.

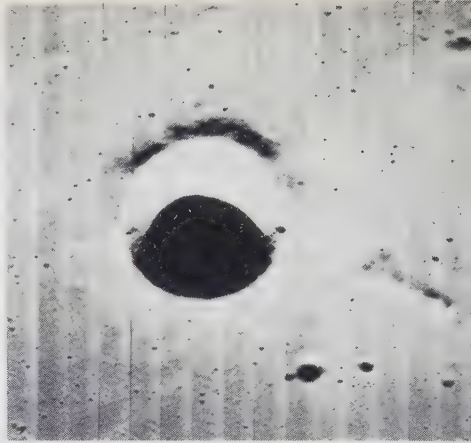
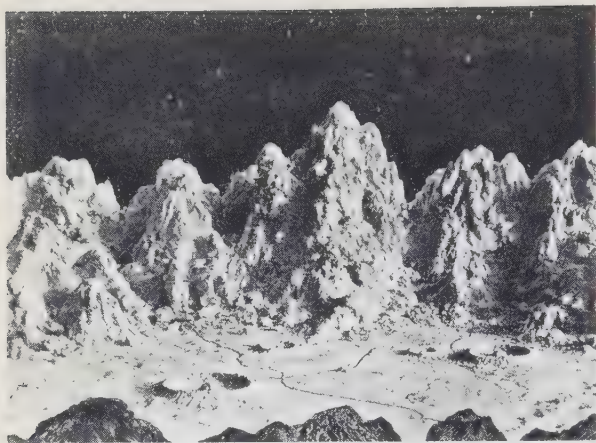


Plate 4. (Left) Steep lunar mountains, as depicted by Nasmyth and Carpenter, *The Moon*. *Plate 5.* (Right) Typical cup-shaped impact structure, located in the Ocean of Storms (Oceanus Procellarum). The center coordinates are about $36^{\circ}30'$ west longitude and $9^{\circ}20'$ latitude. Photo credit: NASA, Lunar Orbiter 1.

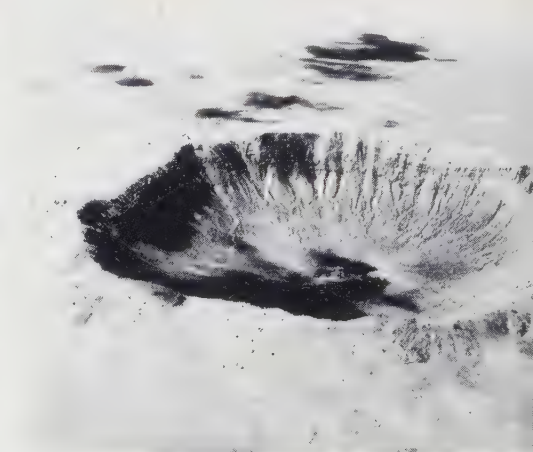
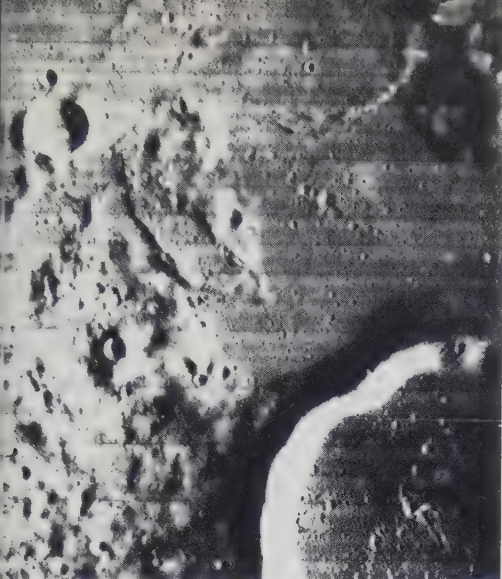
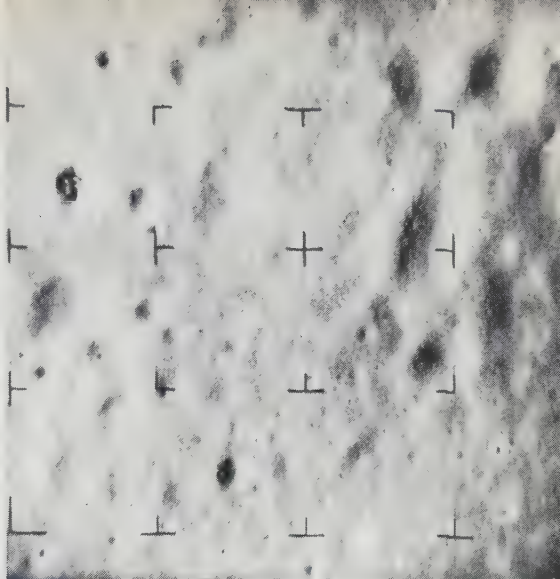


Plate 6. (Left) The crater Tycho, famous for its long rays, was photographed by Orbiter 5. Note the very rough interior. Much debris is scattered within and outside the crater. Extensive terracing is very conspicuous. Radially disposed features are seen to radiate away from its rim. The inner peaks are sharp and angular. This crater is probably due to a recent impact. Its diameter is 50 miles. Photo taken from 135 miles up. Photo credit: NASA. *Plate 7.* (Right) Arizona's Meteor Crater. A few geologists have estimated it to be about 5,000 years old; others believe it may be as old as 50,000 years. Supposedly a large meteoritic body, about 20 meters in diameter and weighing approximately 10 to 20 million tons struck the earth's surface. Photo courtesy, American Museum of Natural History.



8. (Top Left) The crater Gambart, fully shown. This photograph was taken by Lunar Orbiter 1. The coordinates are $5^{\circ}40'$ west longitude and $1^{\circ}20'$ latitude. Photo credit: NASA.



9. (Top Right) Ranger VII photograph showing an area about one and two-thirds miles on one side, taken from an altitude of about three miles. The largest craters are about 30 feet in diameter and ten feet deep. Note the rock partially buried in a crater which may be responsible for its origin. Note the predominance of craters with rounded rim profiles. The area of impact is located near Cognitum. North is at the top. Photo: NASA. Plate 10.



10. (Center R) This photograph, taken by Lunar Orbiter III, shows part of the floor of the large crater Oceanus Procellarum. This crater is about 60 miles in diameter and about 6,500 feet deep. The area shown is approximately 25 by 30 miles and was taken from an altitude of 38.5 miles directly above it. Photo: NASA. Plate 11.

11. (Bottom R) The moon's Harbinger Mountain, at 43° west longitude and 27° north latitude, taken from an altitude of about 38.5 miles by Lunar Orbiter V. Center is Rima Prinz I; left is Rima Prinz II.

12. (Bottom Left) This photograph shows some of the famous lunar rilles, which may have been formed either by flowing water or volcanic eruptions. Rima Prinz II starts at a crater 2 miles in diameter, runs north in a channel 40 miles long. The valley is 1,000 feet wide near the head and narrows to 500 feet near the end. Photo: NASA.

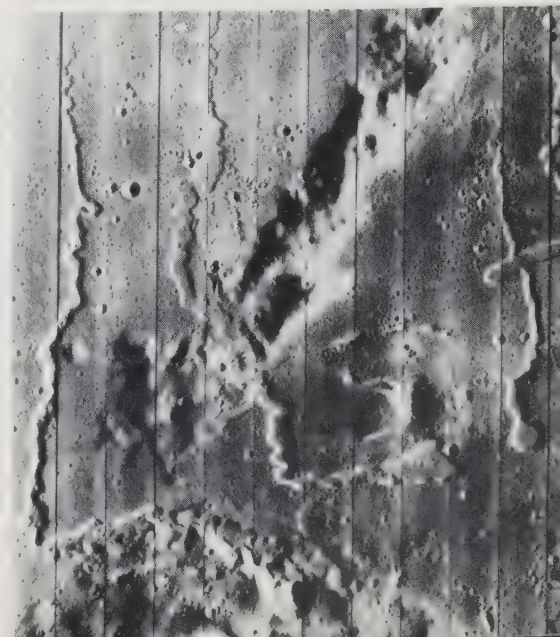




Plate 12. The famous Hyginus Rille and crater, taken by Orbiter III. The crater is $6\frac{1}{2}$ miles in diameter and $\frac{1}{2}$ mile deep. The photograph was taken from an altitude of 39 miles. Photo credit: NASA.

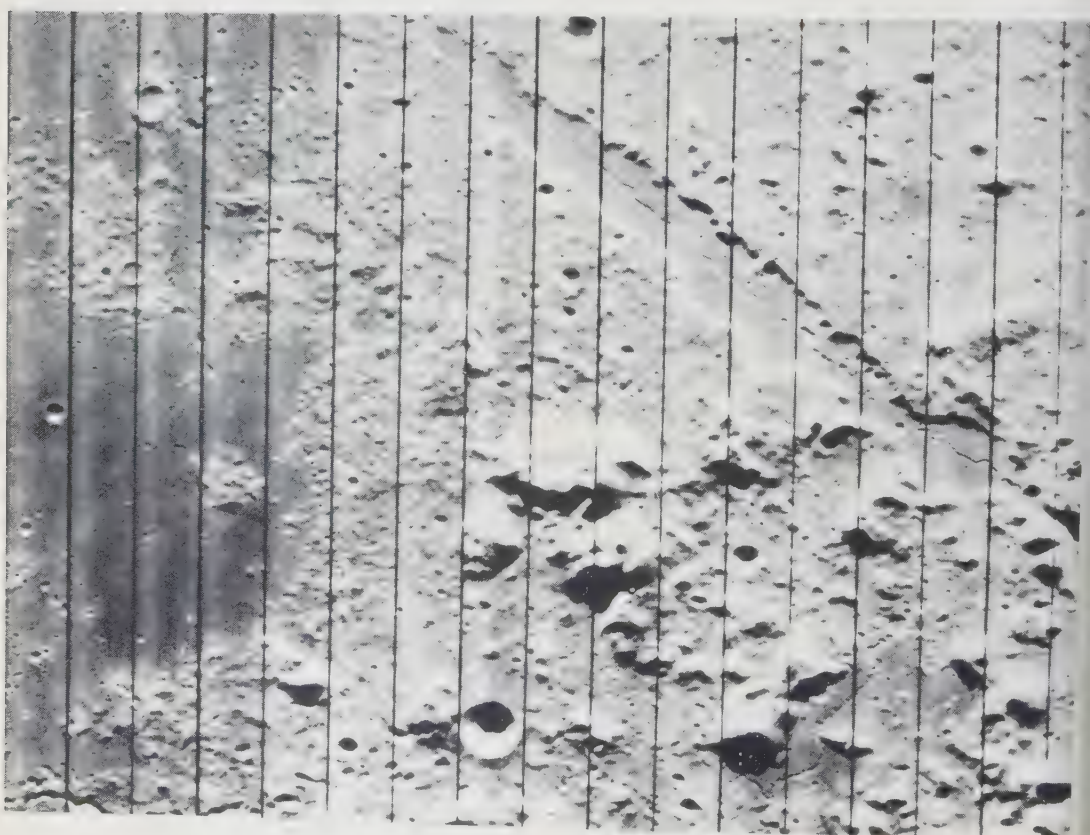


Plate 13. The Alpine Valley, taken by Lunar Orbiter IV, from an altitude of approximately 1,800 miles. This enlargement from the Orbiter frame shows a straight cleft in the highlands northeast of Mare Imbrium. Photo credit: NASA.

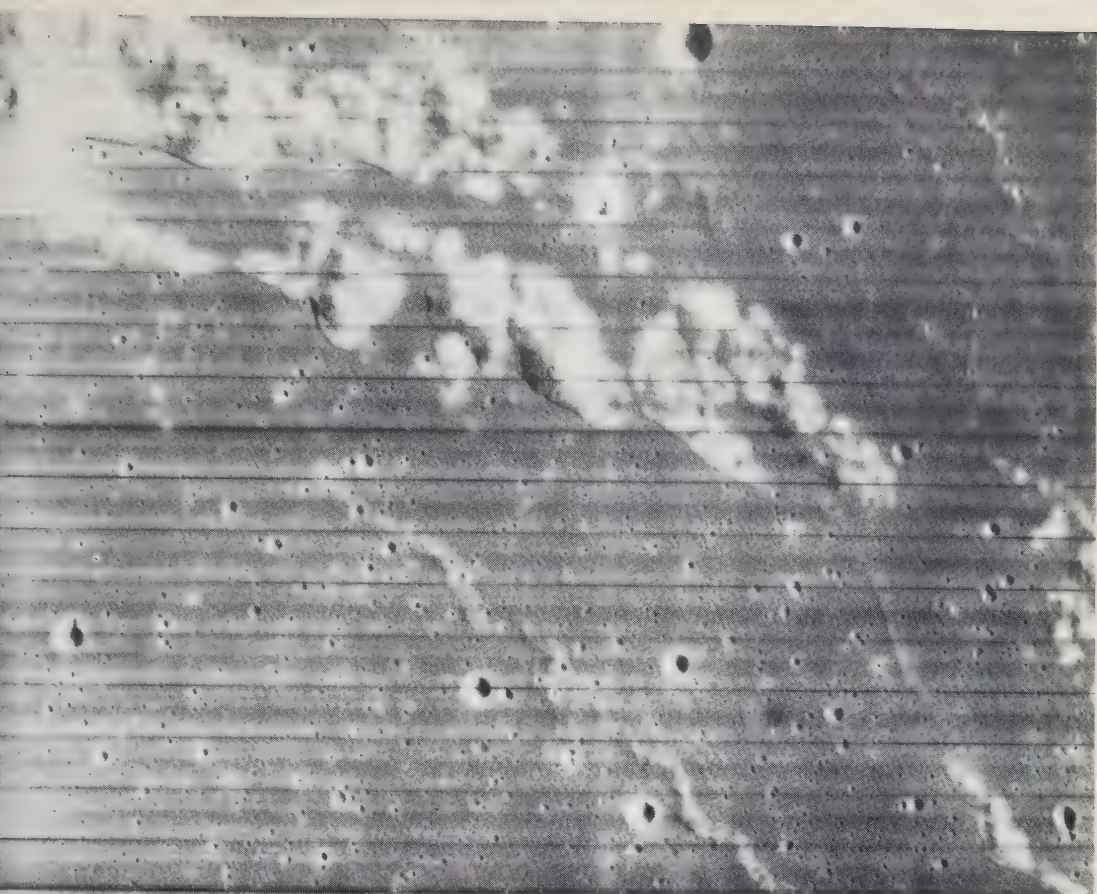


Plate 14a. Lunar Orbiter I photograph of a portion of the old ghost crater near Flamsteed. This is the area where Surveyor I landed. The bleb-like domes in the upper part of the photograph can be seen in a panoramic view by Surveyor I in Plate 14b. The area is approximately 20 by 24 miles. The center coordinates are about $43^{\circ}00'$ west longitude and $2^{\circ}20'$ south latitude. Photo credit: NASA.

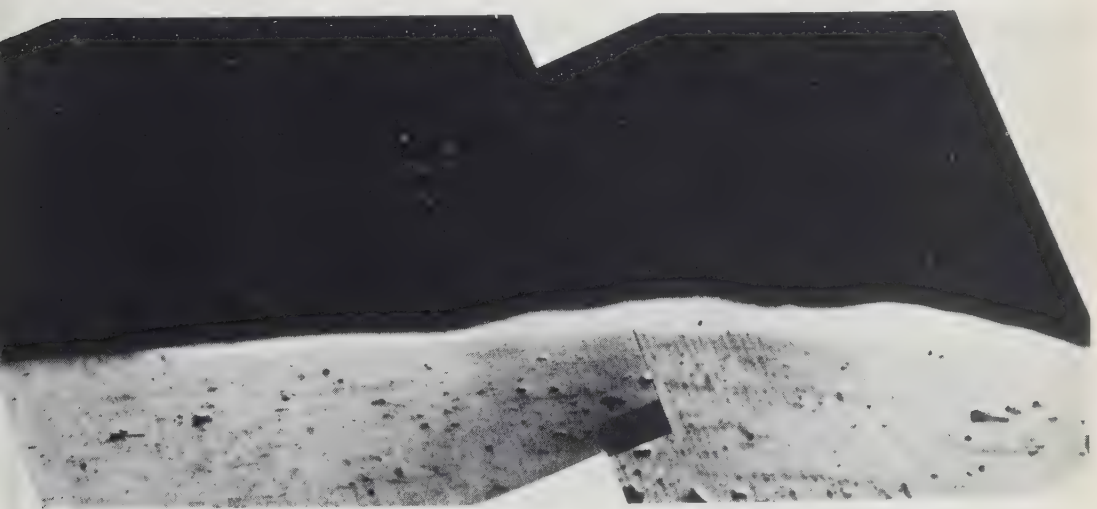


Plate 14b. Surveyor I photograph, panoramic view of the crest of a small mountain range. It is part of the rim of a nearly buried ancient crater over 60 miles in diameter, shown in Plate 14a. Photo credit: NASA.

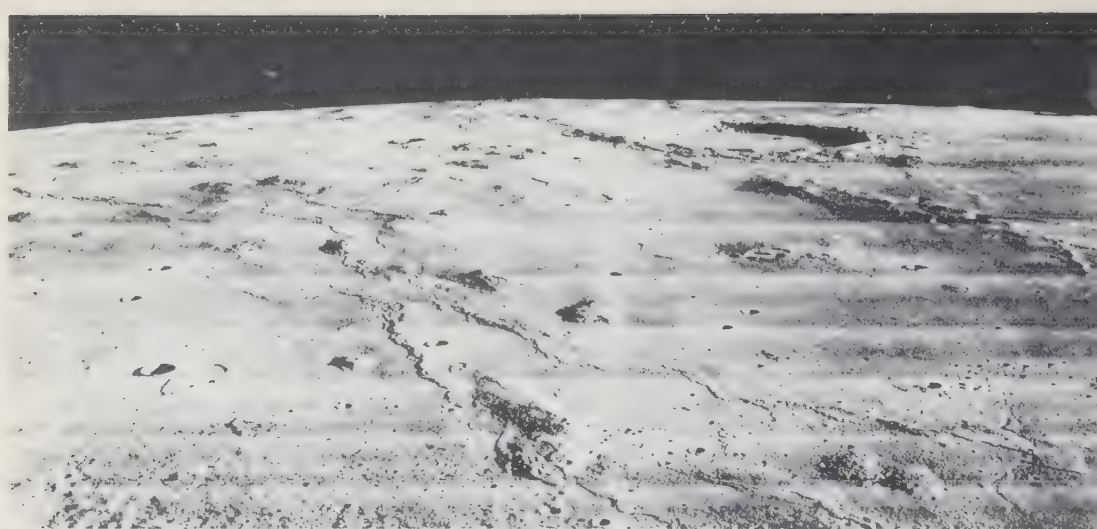


Plate 15. The Marius Hills, taken by Lunar Orbiter II. This region has been compared to volcanic terrain of northern California and Oregon. Note the domes. The large crater in the distance is Marius, with a diameter of 25 miles and a depth of one mile. Note the "frozen waves of lava." Photo credit: NASA.

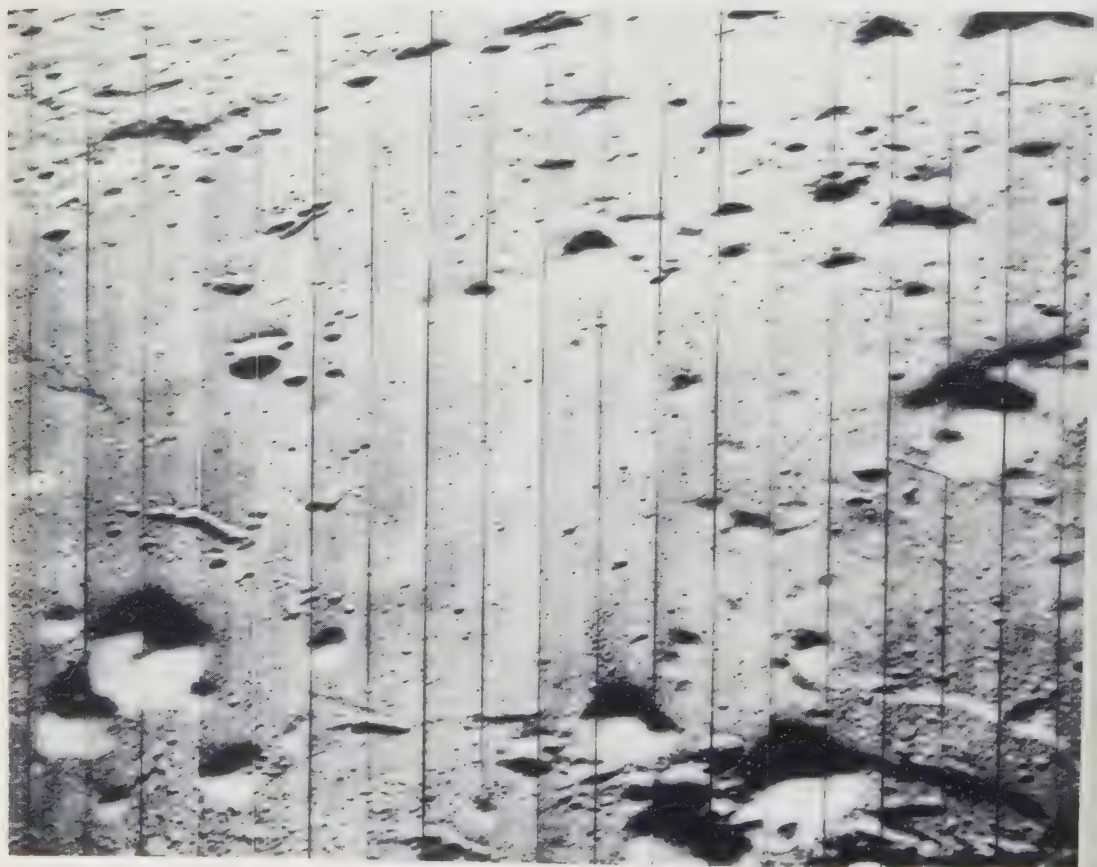


Plate 16. The area, measuring about 23 by 28 miles, is located west of the crater Gambart. Center coordinates are about $19^{\circ}40'$ west longitude and $1^{\circ}20'$ north latitude. North is at the top. Photo credit: NASA-Orbiter.

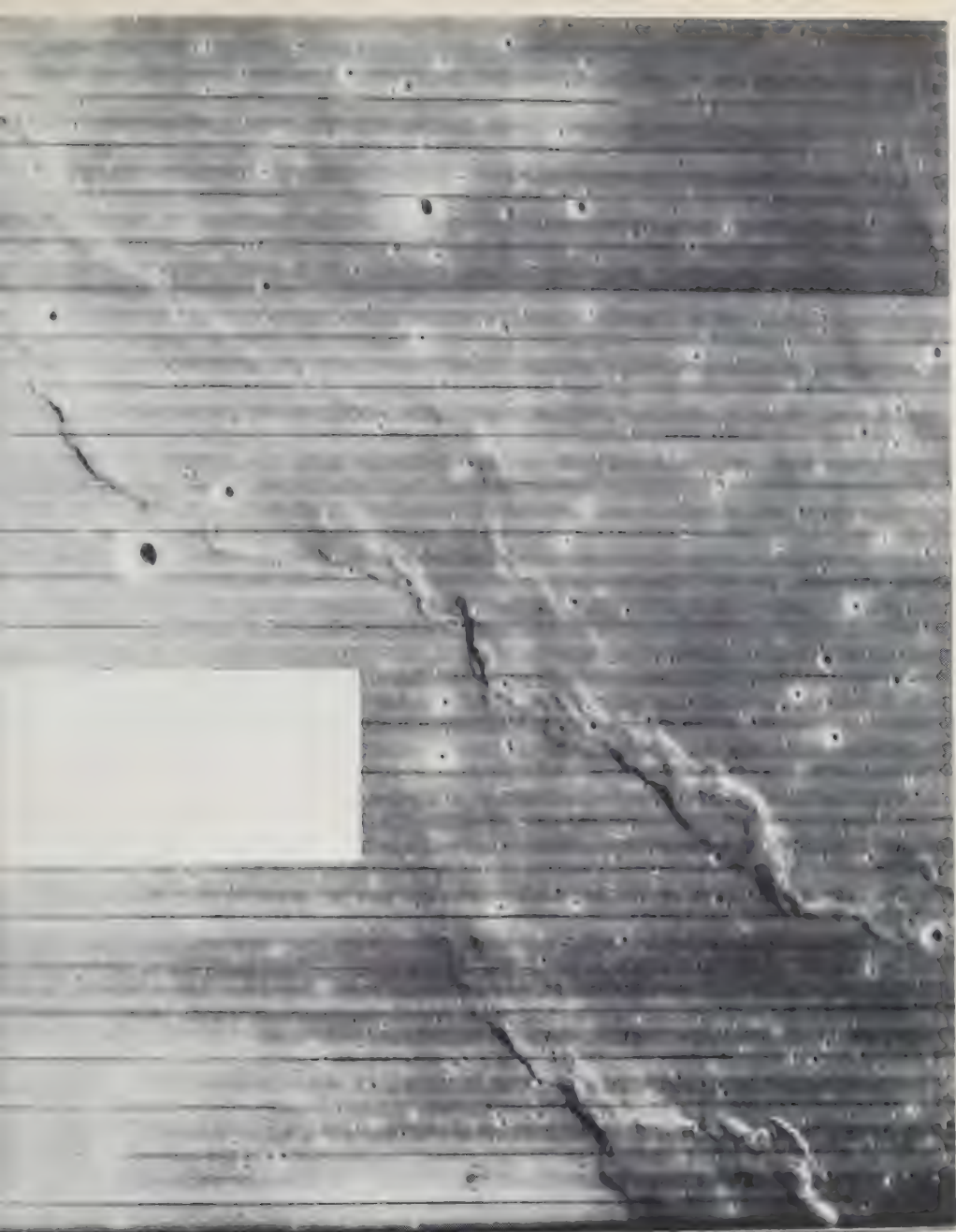


Plate 17. Lunar Orbiter 1 photograph, showing wrinkle ridges in the Ocean of Storms. Area shown is about 21 by 25 miles. The center coordinates are approximately $26^{\circ}00'$ west longitude and $3^{\circ}20'$ latitude. North is at the top. Photo credit: NASA.



Plate 18. Lunar surface, facing southeast. Note the semiangular rocks and rockstrewn field at right of center. The rock specimen in the foreground is about 2 meters from the camera, about 1 foot in diameter. Photo credit: TASS photo from Luna 9, via UPI Cable photo.

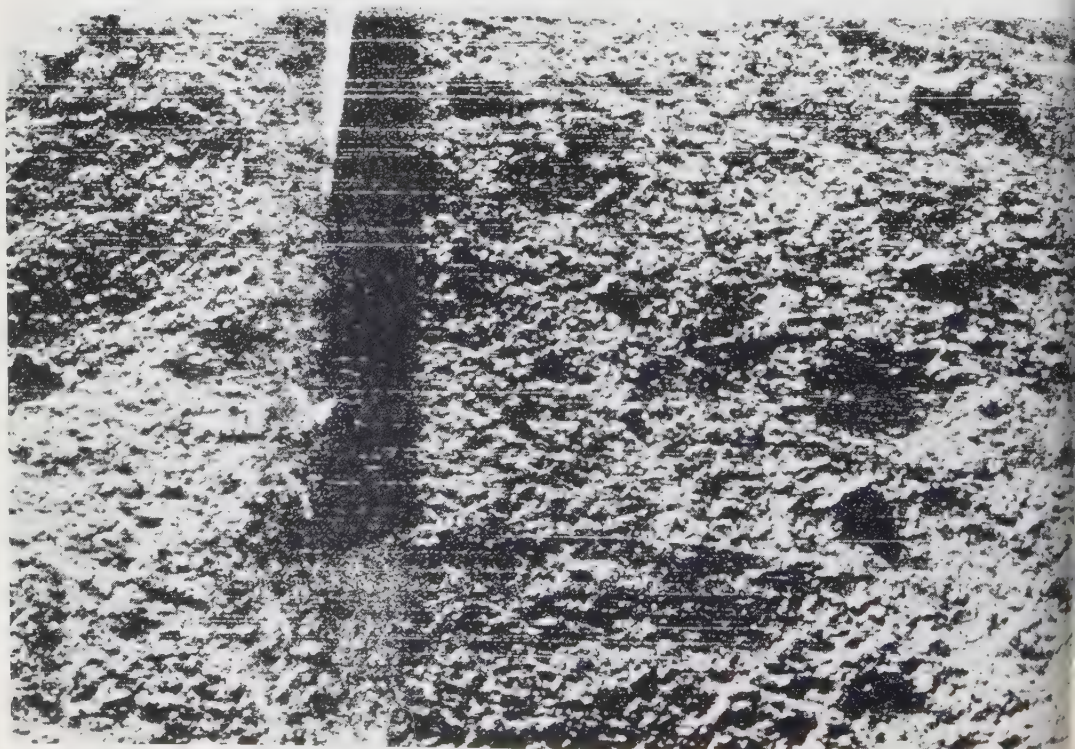


Plate 19. Highly porous (vesicular) lunar surface, similar to that found on certain lava flows on earth. The surface is pockmarked by impact craters. Note the shallow and smoothwalled depressions which are probably collapse features. Photo credit: TASS photo from Luna 9, via UPI Cable photo.



Plate 20. Outside rim of crater (viewing south): Note the sharply angular rock fragments up to two yards in size. Photo credit: NASA photo from Surveyor I.



Plate 21. (Left) Narrow-angle view of Surveyor 1 footpad. Particles about 500 microns can be resolved in the disturbed surface next to the footpad. Photo credit: NASA. *Plate 22.* (Right) Surveyor 1 footpad. Note the darker throwout material near footpad 2. This was contrary to predictions. Photo credit: NASA.

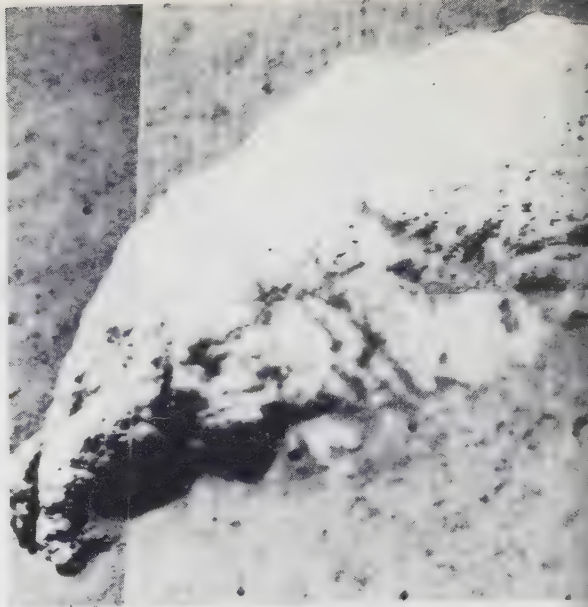
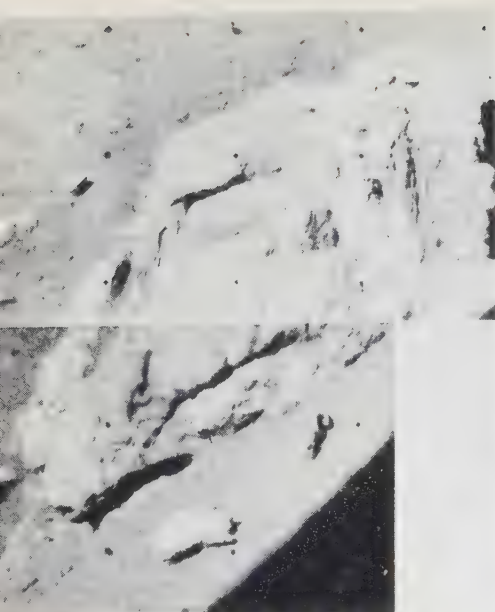
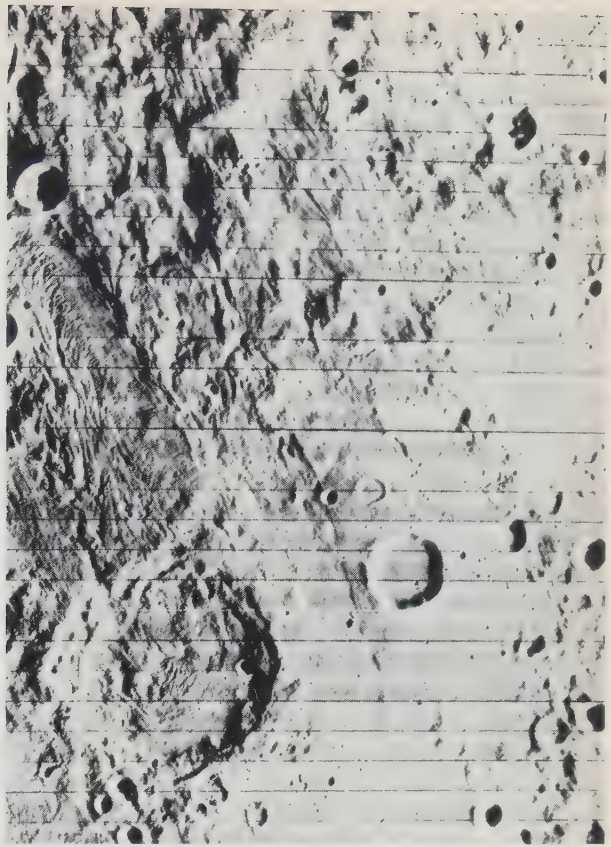


Plate 23. (Left) The rock shown is approximately six inches high and 18 inches long. Distance from camera to rock is approximately 12 feet. Note the joints on the rock. Photo credit: NASA from Surveyor 1. *Plate 24.* (Right) Characteristically mottled and fractured lunar rock. Vesicular structure is apparent. The view is southwest. Photo credit: NASA photo from Surveyor I.



Plate 25. Approximately 50 square meters of lunar surface. The large rock is about 1 meter in length. Particle alignment or preferred orientation is apparent. Photo credit: NASA from Surveyor I.

26. Lunar Orbiter IV photograph. Coordinates for the center of the photograph are approximately 68° west longitude and 43° south latitude. The crater in the lower lefthand is Inghirami. The diameter is miles. Note the flow-like features. Photo credit: NASA.



27. Lunar Orbiter IV photograph. NASA's own words, "an area of lunar displaying evidence of a very complicated geological history. . . ." This picture, made near the western edge of the moon's visible surface, shows the crater Riccioli at right center, and is 100 miles in diameter. North is top. The coordinates for the center of the photograph are approximately 77° west longitude and 43° south latitude. Photo credit: NASA.

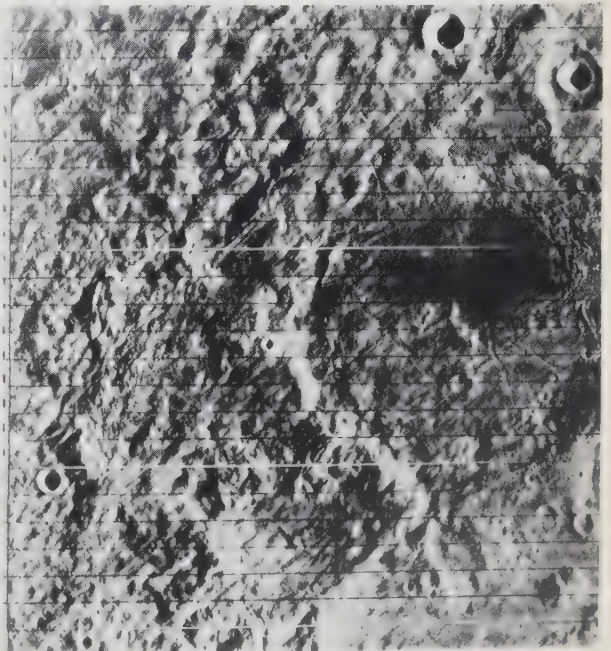




Plate 28. Lunar Orbiter IV photograph from an altitude of 1,690 miles. The dark flat basin at the left is Mare Orientale (Eastern Sea), which is about 186 miles in diameter. The dark irregular area is called Mare Veris (Spring Sea), at the foot of the Rook Mountains. Center coordinates are approximately 90° west longitude and 16° south latitude. Photo credit: NASA.

arcuate wrinkle ridges more or less following the general contour of the margin. East of these ridges (south and southeast of Hippalus), a series of arched, curved rilles, Hippalus 1 and 2, and Campanus 1, may have been produced by tension as a result of subsidence of Mare Humorum. Hence, some investigators argued, compression features parallel to those mentioned above, were created further west, producing the typical wrinkle ridges we see today. The Orbiter photos have strengthened the belief that these features represent volcanic material that has escaped through fractures. A few others have interpreted them to be frozen waves of lava (Plate 15).

THE FIRST SUCCESSFUL UNMANNED SPACE PROBES—RANGER AND LUNA 9

The Ranger and Luna 9 missions had many surprises for all of us. In the light of new discoveries, the controversy regarding the structure of the moon's surface intensified. Scientists did not agree on the origin of craters, maria, and the highlands. Luna 9 showed that the moon's surface is rough on a small scale. The surface appeared to be smooth and gentle on a large scale. The big question was: would the lunar surface prove structurally sound for the support of manned vehicles? This question had not been definitely settled by Ranger. Luna 9, the first successful lunar lander, suggested that the moon's surface was indeed stable. The shift in position of Luna 9, and the presence of many collapse features as seen by the Ranger probes, however, gave the impression that a number of places on the moon did not appear to be stable. This worried many space officials, since a successful manned mission hinged on this vital question. It was suggested that a number of Surveyor spacecraft should land on the moon and cover as wide a variety of terrain as possible. This plan was carried out very successfully. Luna 9 did not show as much detail as the Surveyor spacecraft. The Russian probe gave the distinct impression that the lunar surface was similar to that produced by lava. This may have been due in part to the strong shadows at low sun angle. But the lava-like surface could not be discounted since Luna 9 appeared to have landed on the northwest slope of a small cratered mountain northeast of Cavalerius. On the other hand, Luna 9 revealed many shallow and gentle depressions, attributed by many investigators to collapse of fine overlying material into voids or cavities below. These craters have been seen by all the successful Ranger probes, and described by Urey. Moreover, Luna 9 detected a number of large blocks, scattered over the moon's surface (Plates 18 and 19). The presence of these blocks supported the belief that the lunar surface was sufficiently stable for landing operations. Kuiper, who analyzed the pictures, stressed the fact that in a sea of

dust these large fragments should have been buried in the process of impacting.

Ranger 9, the most sophisticated of the early probes, revealed a number of features within the crater Alphonsus that appeared to be volcanic in nature. It also revealed a number of different types of craters that could not have been due to a single process of formation. The Ranger probes revealed what appeared to be three basic types of craters: impact, collapse, and dark-halo. Impact craters are attributed to the explosive action when small and large meteorites collided with the moon's surface with great force, producing rimmed, cup-shaped depressions, and flat-bottomed, rimmed craters with central peaks. The large craters have terraced walls within. Tycho is a good example (Plate 6).

Collapse features may have developed as a result of material draining into hollows below. Dark-halo craters were attributed to volcanic action. Prior to Ranger, we could only speculate on the presence, size, and distribution of rubble on the moon's surface. Indeed, the Rangers revealed very few, if any, rockstrewn surfaces, and hence gave the impression that the lunar surface was conspicuously devoid of rubble. Some observers attributed this to two factors: first, the resolving capabilities of the Ranger cameras were not sufficient enough to record fine detail; second, the regions scanned were perhaps not in areas affected by recent impacts. Kuiper commented as follows: "The absence of rock strewn all over the lunar surface is a striking aspect of the Ranger photographs."

Ranger photos confirmed radar studies that the lunar surface is smooth and undulating on the decimeter and meter scale. The reader should remember, however, that the Rangers did not reveal the vast quantities of rubble that is present in some areas of the moon, particularly near impact craters. Small debris and small craters, however, may have been obliterated in places by the constant bombardment of micrometeoroids. In reference to Ranger VII, Kuiper (5) said: "A survey of slopes in the last partial scan photograph revealed that slopes over 10 per cent of the area photographed were less than 1 degree (measured over 1 meter slope lengths), slopes over 50 per cent of the area were less than 5 degrees, and slopes over 90 per cent of the area were less than 15 degrees. The roughness of a surface of this type does not appear to present an unreasonable risk to landing Surveyor or Apollo spacecraft."

The terraced walls of the large crater Alphonsus have an average slope of 10 to 15 degrees. Some dark-halo craters within Alphonsus have only 2 to 3 degrees of slope outside their rims.

Project Ranger made it possible to extend the known depth-

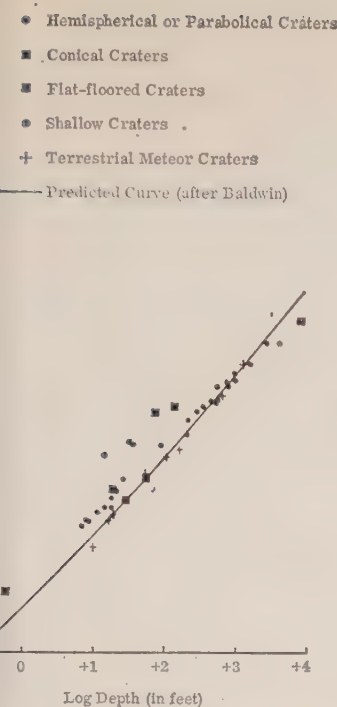
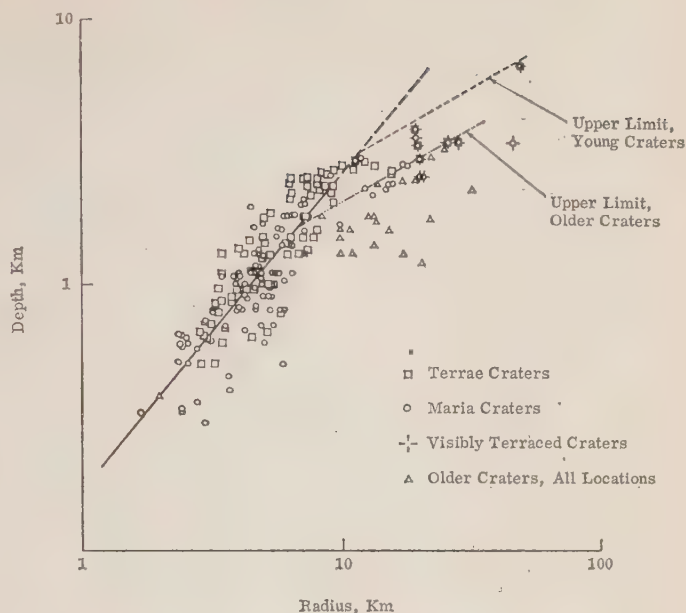


Fig. 3. Diameter-depth relationship for lunar craters studied on Ranger VII photographs (J. E. Westfall [LEFT])

Fig. 4. Depth-radius relationship of selected lunar craters. (After Quaide-et al) [RIGHT]



diameter relationships of craters about 3 orders of magnitude smaller than before. Westfall (18) made a preliminary analysis and plotted the depths and diameters of some 42 craters (Fig. 3). Quaide (19) *et al* studied radius-depth relationships of lunar craters. Their studies show that lunar craters less than 20 kilometers in diameter are fairly constant as to depth-diameter relationships. Craters larger than 20 kilometers depart from this relationship in that they are shallower per unit diameter (Fig. 4). Behm (20) measured depth-diameter relationships of some 115 craters. Most were less than 20 kilometers in diameter. The results are shown in Fig. 5.

However, an exact estimate of depth-diameter relationships is difficult due to the presence of three basic crater types. Unequal erosion of many craters shows that their original times of formation varied considerably. Presumably, every square yard of the lunar surface has been pockmarked at one time or another. As soon as the craters were formed, they were exposed to an incessant shower of

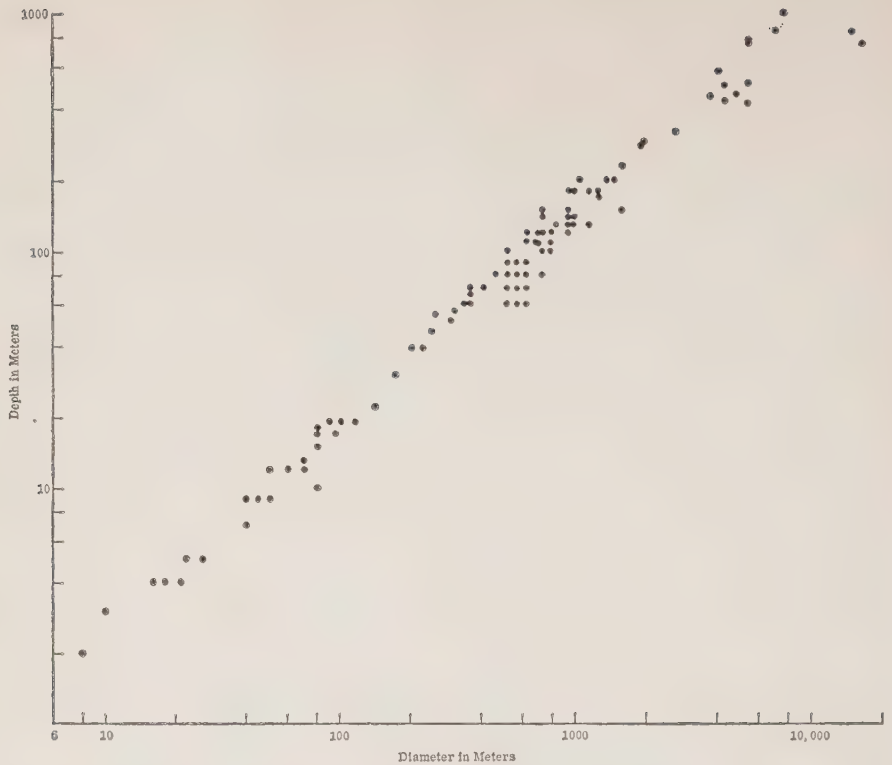


Fig. 5. Depth-diameter relationships of lunar craters in meters. (Based on Ranger VII Lunar Charts RLC 2 through RLC 5, published by Aeronautical Chart and Information Center, U.S.A.F., St. Louis, Mo.) (After Behm)

micrometeoroids, which reduced the height of crater rims, and filled the floors.

THE SURVEYOR MISSIONS

The Surveyor missions did prove that the greater part of the lunar surface consists of unassorted, angular to very angular, and rounded rock fragments of all sizes, ranging from less than a millimeter to blocks several meters across (Ref. 21 and Figs. 6 and 7). Surveyor 1, for example, landed in the vicinity of what appeared to be the rim of an impact crater (Plate 20). Had this probe landed any closer, the mission might have ended in failure. From earth-based photography, the lurain within the old ghost-crater north of Flamsteed appeared deceptively smooth. Patches of what appeared to be splashes of material brighter than the surrounding lurain cross the crater, suggesting that they are part of the ray system of the large crater Copernicus.

What else did the Surveyors show? They confirmed that the surface of the moon was stable enough for landing and basing operations. They also showed that the moon's surface is made up of un-

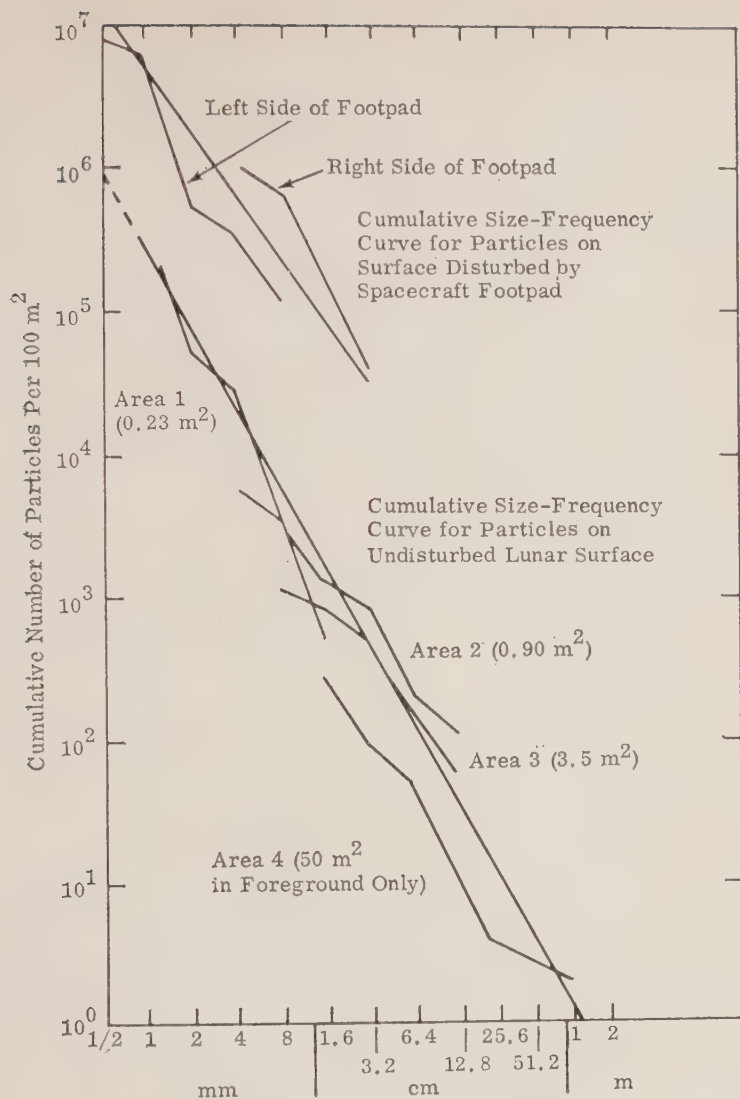


Fig. 6. Cumulative frequency distribution of particles on the lunar surface as determined by Surveyor 1 photographs. (After Jaffe, et al) (Credit NASA)

assorted debris of all sizes, which appears to be granular rather than vesicular (Plate 21). The disturbed surface material next to one of Surveyor 1's footpads suggested a surface similar to volcanic ash but not resembling a lava surface. Throwout material from below the original undisturbed surface turned out to be darker, contrary to what was expected (Plate 22). Some of the nearby rocks recorded by Surveyor 1 showed vesicular structures. The term "vesicle" refers to openings or cells present in volcanic rock (Plates 23 and 24). The origin of the scattered rocks has not been definitely established, though they appear to be of impact origin. Surveyor missions have confirmed that impact by meteoroids is an important

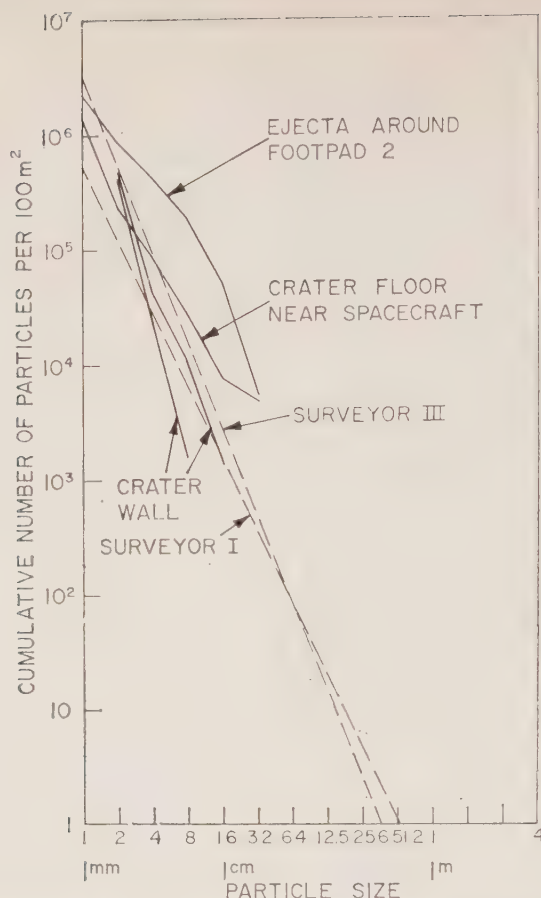


Fig. 7. Size-frequency distribution of particles and fragments on the lunar surface around Surveyor V. (Photo credit, NASA)

process molding the lunar surface. Alignment, or preferred orientation of particles, can be seen in Plate 25.

Fig. 8 shows the chemical composition of the lunar surface at Surveyor V site. These were preliminary results. Fig. 9 shows a bar-chart comparing the analysis of the first area covered by the alpha scattering experiment with those of chondrites, basaltic achondrites, and tektites. Fig. 10 shows a bar-chart comparing the analysis of the first area covered by the alpha scattering experiment with those of dunite, basalt, and granite.

THE ORBITER MISSIONS

The Orbiter missions have revealed much rubble and rock debris within a number of lunar craters. It confirmed Ranger findings that most rims of larger craters are very smooth in contrast to the adjacent, heavily cratered mare lurain. Lunar Orbiter 2 has shown what

CHEMICAL COMPOSITION OF THE LUNAR SURFACE
AT SURVEYOR 5 SITE (PRELIMINARY RESULTS)

ELEMENT	PERCENT OF ATOMS
CARBON.....	< 3
OXYGEN.....	58 ± 5
SODIUM.....	< 2
MAGNESIUM.....	3 ± 3
ALUMINUM.....	6.5 ± 2
SILICON.....	18.5 ± 3
SULFUR → NICKEL*	13 ± 3
HEAVIER THAN NICKEL.....	< 0.5
*IRON, COBALT and NICKEL.....	> 3

Fig. 8. Chemical composition of the lunar surface at Surveyor V site (preliminary results). (Photo credit, NASA)

some investigators call “rolling stones,” because they seem to have rolled down inclines and the walls of some craters, leaving distinct trails in the lunar soil. Eggleston (22) noted these features and evaluated them in the light of potential landing sites on the moon. Most authorities agree that Tycho is an impact crater (Plate 6). It displays all the phenomena associated with shock. Its rays have been primarily formed by secondary impacts, the interior of the resultant craters being much brighter than their surroundings.

There are a number of areas that appear as if portions of the lura had been melted, showing flow-structures and a great variety of bleb-like features. Some investigators have attributed this to melting brought about by shock produced by infalling meteoroids (Plates 26, 27 and 28). Many craters show their floor substance to be cracked, with concentric shrinkage lines along their periphery. This, some volcanologists believe, is evidence for volcanism. They refer to a common phenomenon of ebbing taking place in lava pools on earth.

A close-up of the famous Cobra Head by Orbiter V suggests that some kind of fluid was responsible for its formation. This feature, located at Latitude 25°N and Longitude 49° W is located northwest

of the crater Aristarchus. This area became the target of intensive studies as a result of the appearance of red spots, interpreted as lava outpourings by some investigators, and as gas emissions, by others. A high-resolution photograph of Schröter's Valley shows evidence of heavy erosion into the lunar surface. Large-scale slumping along the rim is readily discernible. Some scientists have described meandering patterns that supposedly isolated several former channels and spilling over old banks. There is no question that some kind of fluid excavated this feature. The difficult question is: was it water or some kind of volcanic activity that produced this feature? What further complicates this problem is the fact that the analyses of samples brought back from the moon by the manned missions seem to point to the fact that water may have never been present on the moon's surface. Nuée ardente variety of volcanism may have shaped these features, a number of selenologists have suggested. The term nuée ardente is a term used to describe a highly heated mass of gas-charged lava, more or less horizontally ejected from a vent or pocket at the summit of a volcano onto an outer slope where it continues on its course as an avalanche, flowing swiftly, however slight the incline, by virtue of its extreme mobility. This occurred on the island of Martinique in 1902, when Mt. Pelée was shaken by violent explosions, producing nueés ardentes, and which destroyed the town of St. Pierre. This type of volcanic eruption has been used to explain the origin of sinuous rilles (see section on "Fracture Structures").

What has mystified a number of selenologists is the Orbiter photograph showing the famous Alpine Valley (Plate 13). The valley, as explained previously, has a remarkable similarity to canyons on

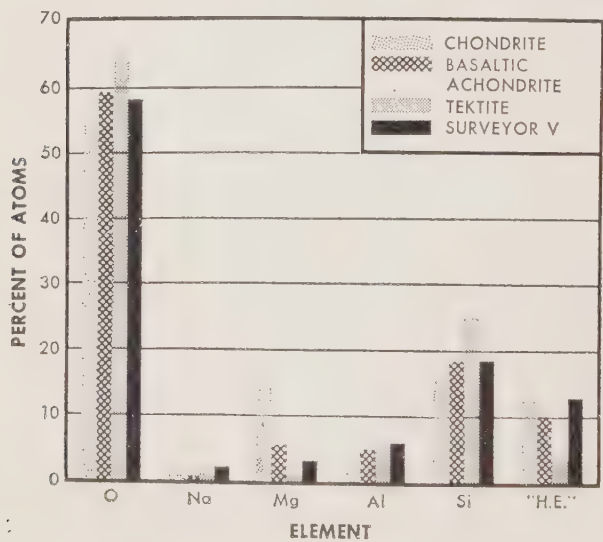
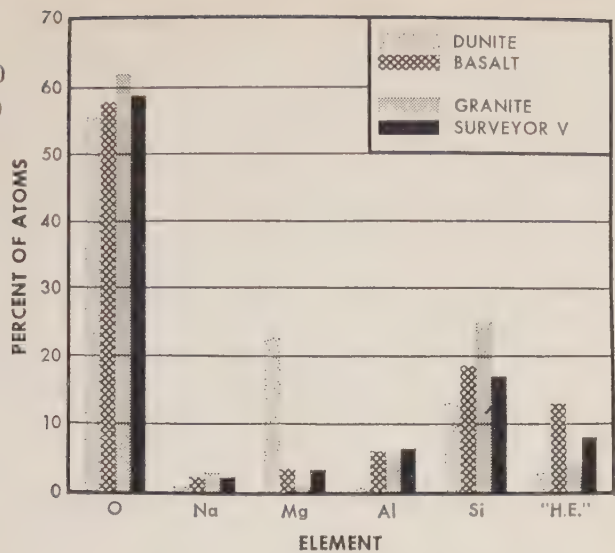


Fig. 9
(Photo credit, NASA)

Fig. 10
(Photo credit, NASA)



earth, for example, the canyons produced by the Colorado River. A meandering channel is clearly depicted on the floor of this valley. Some authors have concluded that this feature was due to the breakthrough of lava through highland terrain to the north, the lava having originated in Mare Imbrium, shown in the top third of Plate 13, and the channel having been produced by the inflow of molten material. As discussed in the section on craters, Mare Imbrium was created as a result of a low-angle impact by a large asteroidal body, causing widespread melting and flooding of the lunar surface. This idea was originally proposed by Gilbert, whose views have been discussed in the section on craters. Nobel Laureate Urey also thought that this valley had been produced by the impact that created Mare Imbrium.

The Orbiter missions revealed that the mass of the moon is greater toward the side eternally facing the earth. Data also suggested that the moon is not as dense in its center, as once thought.

One of the most startling revelations by Orbiter were the so-called mass concentrations (mascons), which caused perturbations in the orbit of the spacecraft. These mascons appear to be located in the central portions of the maria. A number of investigators suggested the presence of buried, large metallic objects, due to impacts.

Structurally, lunar impact craters are strikingly similar to impact craters on earth. This has been amply proven by the Orbiter missions. Though Orbiter photos have suggested that the lunar highlands were chemically distinct from the lowlands, or maria, the Surveyor's analyses have shown that the similarities outweighed the dissimilarities.

Orbiter photography has shown a number of areas on the moon that look distinctly volcanic. Whether these areas were due to endogenous, or exogenous factors, is difficult to explain.

So-called radial fracturing on the floors of several craters has suggested to some scientists lunar volcanic features similar to those on earth, for example, calderas. Some of these patterns were revealed by telescopic observation, but the Orbiters showed them in much greater detail. Meteorists have ascribed this grid-pattern, polygonal in places, to violent impact.

One thing is certain. The unmanned missions revealed a lunar surface far more complex than hitherto anticipated. The data have shown that not one, or two, but many processes have molded the moon's surface.

Summary

Ranger photographs revealed 3 types of craters—impact, collapse, and dark-halo. The collapse craters appear to be the result of thin crusts that sagged into a void below. Ranger 9 resolved so-called fractures within Alphonsus into crater chains, and showed the walls of Alphonsus and its central peak to be remarkably smooth. The lunar surface was found to be smooth and gently undulating on the decimeter and meter scale. The depth-diameter relationships of craters up to 20 kilometers, when plotted on logarithmic paper, follow a straight line. Photographs at the Luna 9 landing site showed little or no dust but revealed what appeared to be a highly vesiculated rock foam, resembling an aa lava flow. The surface is very rough on the millimeter and centimeter scale. The presence of rocks in Luna 9 and Surveyor pictures suggested that the underlying surface had adequate bearing strength to support the weight of man or spacecraft.

Luna 9 and Surveyor photographs showed rounded, semi-angular, and angular rock fragments, ranging in size from microns to several meters across. Surveyor spacecraft suggested a surface similar to volcanic ash but not resembling a lava surface, as Luna 9 seemed to indicate.

Both Ranger and Luna 9 showed few, if any, fractures. These could, however be hidden below the regolith.

Luna 9 revealed that about 5 to 10 percent of the lunar surface examined is covered by many shallow craters, which appear to be collapse features. But the Surveyor missions showed collapse features, impact craters, and rock blocks in great detail.

The Orbiter missions revealed a wealth of new data. They showed features due to impact origin and confirmed Ranger's findings that the walls of many craters are remarkably smooth in contrast to the adjacent surface. Orbiter corroborated the impact origin of Tycho. A number of flow structures, grid-patterns, and related features were photographed by Orbiter. Sinuous rilles are apparently due to some fluid erosion. The famous lunar Alpine Valley bears a remarkable similarity to canyons on earth.

Mass concentrations (mascons), located in the maria, caused perturbations in the spacecraft's orbit. These features probably are of meteoric origin.

Orbiter photographs of the Marius Hills and adjacent areas suggest a volcanic origin. Grid patterns and peripheral concentric shrinkage lines have been attributed to volcanism by some selenologists, and to impact by others.

Orbiter photography has shown that the origin of the moon's surface has been far more complex than originally assumed. It will take many years of concentrated effort and analysis before meaningful conclusions can be drawn.

REFERENCES

- ¹ Spurr, J. E.: *Geology Applied to Selenology*. Vol. 2, *The Features of the Moon*. The Science Press Co., Lancaster, Pennsylvania, (1945).
- ² Baldwin, R. B. *The Face of the Moon*. The University of Chicago Press, (1949).
- ³ Green, J.: Tidal and Gravity Effects Intensifying Lunar Defluidization and Volcanism. In *Geological Problems in Lunar Research*, *Annals of the New York Academy of Sciences*, Vol. 123, Art. 2, July 15, (1965).
- ⁴ Sytinskaya, N. N.: Meteor-Slag Theory of the Lunar Surface. In *The Moon*. IV, Physical Studies of the Lunar Surface. *Symposium No. 14 of the International Astronomical Union*, 12 (1960). Academic Press, London and New York, (1962).
- ⁵ Kuiper, G. P.: Lunar Results from Ranger 7 to 9, *Sky and Telescope*, Special Supplement, 5 (1965).
- ⁶ Kapp, R. O.: The Surface of the Moon, *Interim*, 12 (1964).
- ⁷ Gold, T.: Ranger Moon Pictures: Implications. *Science*, Vol. 145, September, (1964).
- ⁸ Markov, A. V., *The Moon, A Russian View*. The University of Chicago Press, (1962).
- ⁹ Barabashov, N. P., *The Moon, A Russian View*. Chapter 5, The Physical Properties of the Lunar Surface, A. V. Markov, Editor. The University of Chicago Press, (1962).
- ¹⁰ Rostoker, D. and J. Lamb: The Lunar Surface Controversy. *Industrial Research*, May, (1963).
- ¹¹ Oepik, E. J.: Surface Properties of the Moon. *Progress in the Astronomical Sciences*, Vol. 1, Chapter 5. S. F. Singer, Editor. North Holland Publishing Co., Amsterdam, (1962).
- ¹² Firsoff, V. A. *Surface of the Moon, Its Structure and Origin*. Hutchinson of London, (1961).
- ¹³ O'Keefe, J. A. and A. W. Cameron: Evidence From the Moon's Surface Features for the Production of Lunar Granites. *Icarus*, 1, (1962).
- ¹⁴ Lowman, Jr., P. D.: The Relation of Tekites to Lunar Igneous Activity. *Icarus*, 2, (1963).
- ¹⁵ Walter, L.: Lunar Differentiation Process. In *Geological Problems in Lunar Research*, *Annals of the New York Academy of Sciences*, Vol. 123, Art. 2, (1965).
- ¹⁶ Krejci-Graf, K.: Interpretation of Lunar Surface Features. In *Geological Problems in Lunar Research*, *Annals of the New York Academy of Sciences*, Vol. 123, Art. 2 (1965).
- ¹⁷ Gilvarry, J. J.: The Lunar Origin of Tekites. In *Geological Problems in Lunar Research*, *Annals of the New York Academy of Sciences*, Vol. 123, Art. 2, July 15, (1965).
- ¹⁸ Westfall, J. E.: The Ranger VII Photographs, A Preliminary Report. *The Strolling Astronomer*, Vol. 18, Nos. 3-4, 10, (1964).
- ¹⁹ Quaide, W. L., D. E. Gault and R. A. Schmidt: Gravitative Effects on Lunar Impact Structures. In *Geological Problems in Lunar Research*, *Annals of the New York Academy of Sciences*, Vol. 123, Art. 2, July 15, (1965).
- ²⁰ Behm, H. J.: Results of the Ranger, Luna 9, and Surveyor 1 Missions. *The Journal of the Astronautical Sciences*, Vol. 14, No. 3, May-June, (1967).

²¹ *Surveyor 1. A Preliminary Report.* NASA, SP-126. Compiled by Lunar and Planetary Programs Division, Office of Space Science and Applications, Scientific and Technical Information Division. NASA, Washington, D. C., June, (1966).

²² Eggleston, J. M., et al: Lunar "Rolling Stones." *Photogrammetric Engineering*, Vol. 34, No. 3, March, (1968).

Advice to the Reader

The reader is directed to look up unfamiliar terms in a good contemporary desk dictionary such as *The American College Dictionary*. Or refer to specialized dictionaries such as *Glossary of Geology and Related Sciences* (American Geological Institute); *Dictionary of Geological Terms* by C. M. Rice; or *A Dictionary of Geology* by G. W. Himus.

A Brief Glossary

aa lava flow refers to basaltic lava flows that have a rough, jagged, spinose, clinkery surface. A Hawaiian term.

caldera A large basin-shaped volcanic depression, more or less circular or cirquelike, located on top of some volcanic mountains, produced by explosion, collapse (subsidence) and erosion. The diameter is many times greater than that of the included volcanic vent or vents. Or: a volcanic crater of large size, produced by a combination of explosions of great force and the subsidence or the engulfment of the superstructure of the volcano in the chamber previously occupied by the magma.

lopolithic The word *lopolith* refers to a large floored intrusive that is centrally sunken into the form of a basin. Or: A large, lenticular body of igneous rock, generally concordant (that is, parallel to the layers into which it was emplaced), differing from a sill in that it is depressed so that the upper surface is basin-like.

lurain is used in place of terrain, that is, whenever lunar surface is discussed. (*Terrain* may be defined as a complex group of strata accumulated within a definite geologic epoch, also as the tract or region of ground immediately under observation.)

The Author

Hans J. Behm joined the Grumman Aerospace Corporation in 1963. His first assignment covered lunar surface problems associated with the Lunar Module (LM). Later he was assigned to the Advanced Systems Section to work on lunar surface geochemical sensing and engineering geology problems. In early 1966 he worked on the submarine geology of the continental shelf for the Ocean Systems Department. At present, he is engaged in Earth Resources studies, including applications of remote sensors to geology and analysis of thermal pollution.

Mr. Behm has taught geology, meteorology, and astronomy at Wagner College since 1963. He also taught courses at the Staten Island Institute of Arts and Sciences. He worked as consultant and technical correspondent for E. Leitz, Inc., and previously was associated with the American Museum of Natural History as a micropaleontologist. He collected and studied foraminifera in New York Harbor including Staten Island and coastal New Jersey. His experience with ecology started with these activities.

He is a member of the following: Fellow, AAAS; Member, Sigma Xi; Founder and Senior Member, American Astronautical Society; AAPG; GSA; and various conservation societies. He is cited in various publications including *Rocketry and Space Exploration* by Andrew G. Haley (Van Nostrand, 1959).

Mr. Behm has published articles on aspects of local geology, astrogeology, ecology, and is presently planning a book.

PROCEEDINGS

Staten Island Institute of Arts and Sciences



CONTENTS

Articles

RAGWEED POLLEN COUNT FOR STATEN ISLAND 1969 Joan Kosan, Ph.D.	34
BIRD COUNTS ON STATEN ISLAND 1969-70 Mathilde P. Weingartner	40
COLLEGE STUDENTS AND THE INSTITUTE	44
NATURAL HISTORY RECORDS Mathilde P. Weingartner	53

Book Reviews

"The Road to Ruin" by A. Q. Mowbray, Reviewed by Carlton Beil	57
"The Best Nature Writing of Joseph Wood Krutch" reviewed by Dorothy Kriete	59

Books Noted

"The Hudson River" by Robert H. Boyle	
"Lost Heritage" by Henry Savage, Jr.	
"Terracide" by Ron M. Linton	
"Since Silent Spring" by Frank Graham, Jr.	
<i>Environment</i> , Scientists Institute for Public Information —Commented on by G. K. Schneider	61

Editor: G. K. Schneider

Ragweed Pollen Count for Staten Island 1969

by JOAN KOSAN, PH.D.

The first ragweed pollen count sponsored by the Staten Island Institute of Arts and Sciences was carried out during the 1963 season and served as the initial report in a long range study of air-borne allergens.¹ All procedures used for the 1969 study were similar to those cited in the aforementioned report and a Durham pollen sampler was again utilized. The techniques applied were those established by the Pollen Survey Committee of the American Academy of Allergy.²

In addition to the ragweed pollen count this report also includes data on some of the common mold spores which prevail during the ragweed season. These included *Alternaria*, *Helminthosporium* and *Hormodendrum* (see Fig. 1). Mold spore counts were made in the same manner as the ragweed pollen count, i.e. in number of spores per square centimeter of exposed slide surface.

Results

The results of the 1969 ragweed pollen count were as follows (see Fig. 2:

The first significant buildup of ragweed pollen was noted on August 18th with a count of 4. This culminated at the August peak with a count of 30 just two days later. A second peak in August was attained on the 27th with a count of 22.

On September 1st, 2nd, and 3rd, counts of 27, 68, and 88 were respectively recorded. The last figure also denotes the seasonal peak.

The ragweed count did not exceed 13 for the remainder of the season.

The total ragweed pollen count for the 1969 season in Staten Island was 492.

Results of the mold spore counts are presented in Fig. 3 and Table 1. The relationship of the mold spore counts to each other as well as to the ragweed pollen count can readily be noted and will be discussed later.

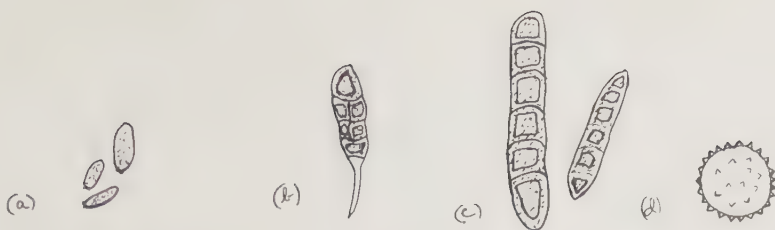


FIGURE 1. Spores of *Hormodendrum* (a), *Alternaria* (b), and *Helminthosporium* (c), showing their general morphology and relative sizes to each other and to ragweed pollen (d). (All drawings 430x/2.)

Discussion

It has already been stated that one purpose of these studies was to evaluate the data from one season to another to see if any meaningful conclusions could be drawn from them.

Earlier studies of ragweed pollen distribution in the New York metropolitan area have shown that any attempt to rid the city of ragweed pollen would necessitate interstate cooperation since about half of the city's ragweed pollen was carried in by westerly and south westerly winds.^{3,4}

The effects of meteorological conditions on the daily pollen count have been noted by Ogden and Raynor.⁵ A clear example of this can be seen in the data presented here for ragweed. As the graph for the 1969 ragweed counts indicates (see Fig. 2), the seasonal peak of 88 was reached on September 3rd. A heavy rainfall accompanied by high winds prevailed during the last two hours of this sampling period. The wind and rain continued through much of the following sampling period. (Indeed, a record rainfall of 3.78 inches was reported for the 24 hour period between 8 A.M. September 3rd and 8 A.M. September 4th.⁶ The pollen count for September 4th was 1. Had we not had the deluge and strong winds a very high pollen count would probably have been encountered for several days.

When one regards both the 1968 and 1969 ragweed seasons together a number of comparisons can be pointed out (see Fig. 4). For example, the first buildup of ragweed pollen occurred on August 18th in both years and seasonal peaks occurred within two days of each other. However, the 1969 peak was $2\frac{1}{2}$ times greater than that of 1968. Indeed almost 18% of the total ragweed count for 1969 was recorded on one day while the seasonal peak in 1968 represented only 9% of that year's total ragweed pollen count. The total ragweed count for 1969 (492) showed a 25% increase over the total for 1968 (394).

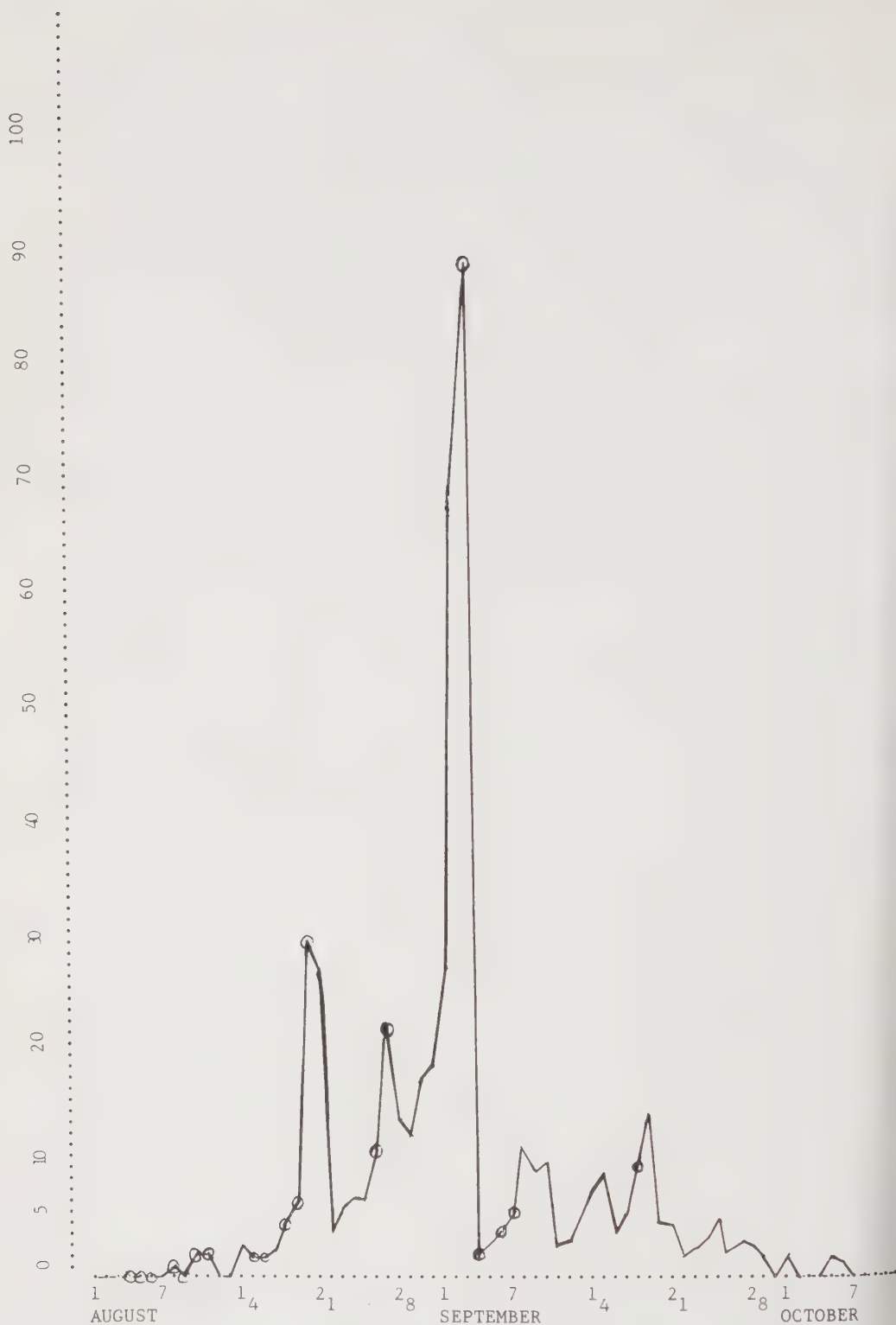


FIGURE 2. Ragweed Pollen Count on Staten Island, August 1 through October 14, 1969. (Circle over count point for date shows precipitation during sampling period.)

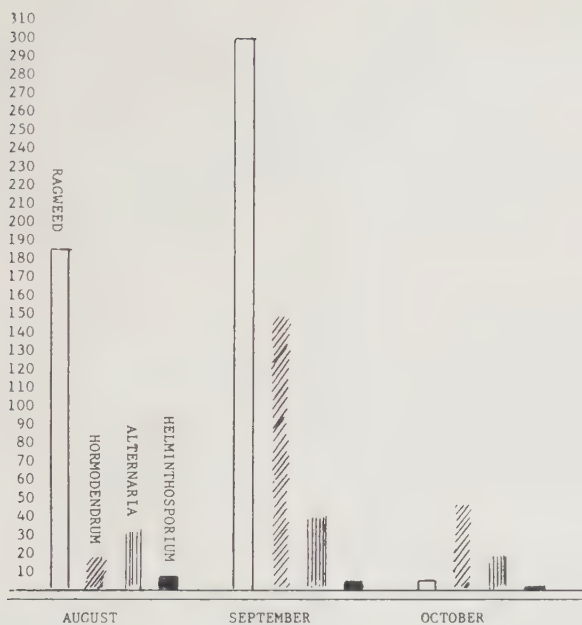


FIGURE 3. Monthly ragweed and mold spore counts on Staten Island for the 1969 season.

The significance of the mold spore counts during the ragweed season was as follows:

The total count for *Hormodendrum* was more than double that for *Alternaria* and *Helminthosporium* combined. Secondly, the October data revealed that while the ragweed pollen count was relatively insignificant in so far as the seasonal total is concerned, the total mold spore counts were significant at this time.

It should further be pointed out that in addition to the counts made of ragweed pollen and spores of *Alternaria*, *Helminthosporium*

TABLE 1. Monthly total for ragweed pollen count and mold spore counts during 1969 season.

	August	September	October	Season Total
Ragweed	187.3	301.3	3.8	492.4
Hormodendrum	18.8	151.2	44.6	214.6
Alternaria	33.5	39.7	20.5	93.7
Helminthosporium	6.7	3.0	1.2	10.9

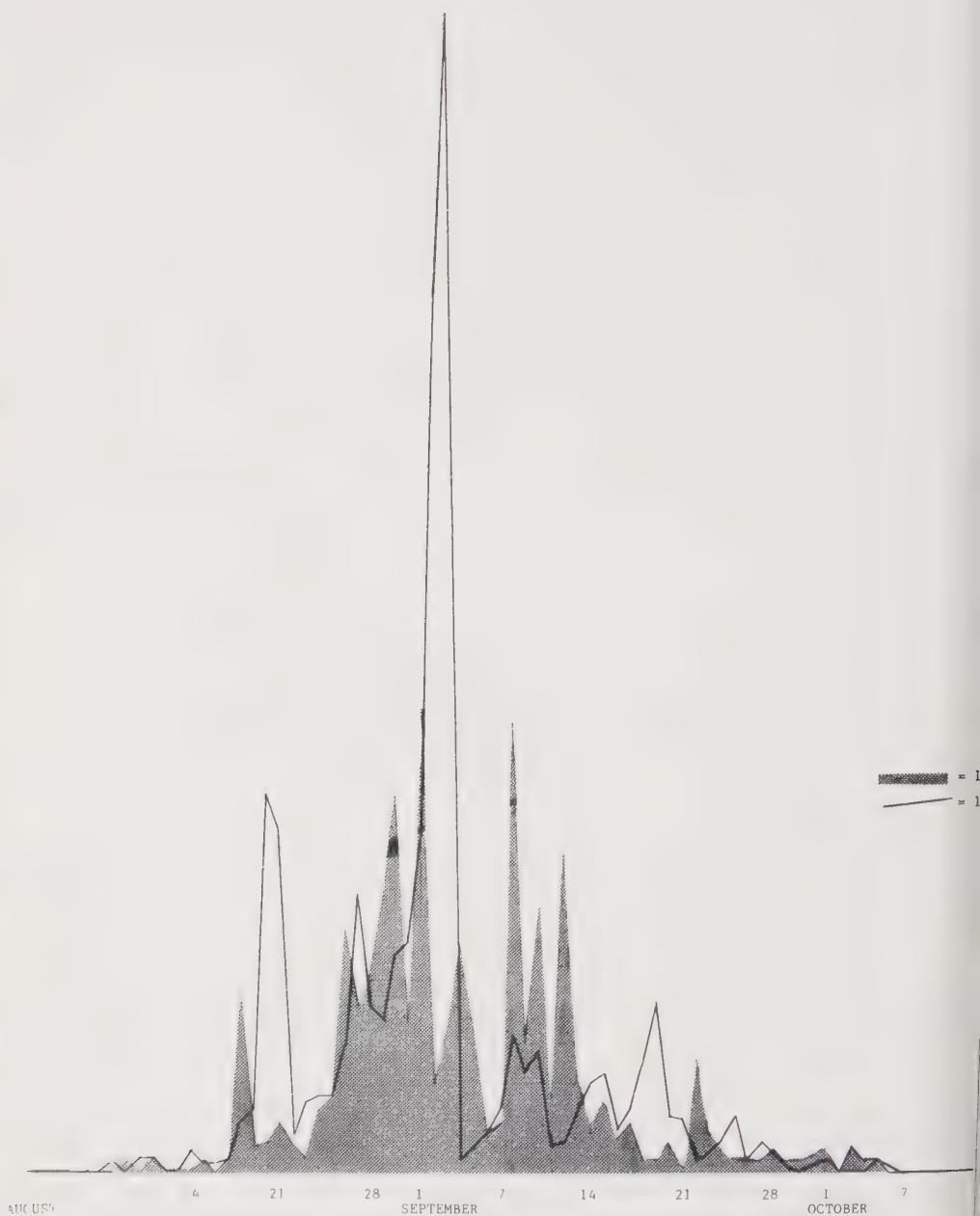


FIGURE 4. Daily ragweed pollen count for 1968 and 1969 seasons on Staten Island compared.

and *Hormodendrum*, other types of pollens and spores were also observed during the 1969 season. These included pollens of grasses, *Chenopodiaceae* species, sagebrush, plantain, hemp, and *Compositae* species as well as several types of mold spores.

The author intends to follow the 1970 ragweed pollen season and will again include *Alternaria*, *Hormodendrum* and *Helminthosporium* spore counts in the study.

References

1. Kosan, Joan "Preliminary Report on Ragweed Pollen Count for Staten Island." *Proc. Staten Island Institute of Arts and Sciences* 24: No. 1, 1, 1969.
2. "Preliminary Report of the National Pollen Survey Committee of the American Academy of Allergy on Proposed Standardization of Pollen Counting Techniques. M. Walzer, Chairman; O. C. Durham, Technical Director." *J. Allergy* 17: 178, 1946.
3. Wiseman, R. D., Sack, S. S., Siegel, B. B., Glazer, I., and Walzer, M. "Studies on Factors Influencing Ragweed Pollen Counts in the New York Metropolitan District. I. Pollen Studies on Ambrose Lightship in New York Harbor." *J. Allergy* 25: 1, 1954.
4. Walzer, M. and Siegel, B. B. "The Effectiveness of the Ragweed Eradication Campaigns in New York City." *J. Allergy* 27: 113, 1956.
5. Ogden, E. C. and Raynor, G. S. "Field Evaluation of Ragweed Pollen Samplers." *J. Allergy* 31: 307, 1960.
6. *The Staten Island Advance*. Weather Statistics, September 4, 1969.

Bird Counts on Staten Island 1969-1970

by MATHILDE P. WEINGARTNER

This year's Christmas Bird Count, taken on December 21, 1969, was interesting in a number of ways and reflected a variety of conditions: It was a high count, both in the number of species seen (85) and the total of individuals counted (93,068). Twenty-one observers were in the field; the number of our local birders was swelled by the addition of some of the experts from the Brooklyn Bird Club who gave unstintingly of their time and energy.

The natural areas in and around Staten Island had been further reduced because of extensive building and land-fill; therefore the nine parties into which the total group was divided could cover the territory thoroughly.

The weather was probably the most obliging ever: Little wind to keep the birds low in the cover; sunlight so that we could distinguish their coloring more readily; just a dusting of snow, no need for difficult walking in deep drifts, and no ice on the roads to make driving hazardous.

A light freeze had covered most of the ponds with ice but there was some open water in each pond where ducks could concentrate and thereby easily be counted. There was one exception, Wolfe's Pond, which was completely covered with ice and had no birds on it.

Some circumstance in the North—possibly a poor cone crop in the evergreens—sent many northern finches scurrying south. The height of the migration had been in November but many of these birds were still around on December 21.

Therefore the high count reflected all of these conditions including the better coverage of the Island. Each party, at the end of the day, seemed to have observed a rarity so that all went home happy and well satisfied.

There was a low count in waterbirds off-shore. Although two weeks earlier thousands and thousands of ducks could easily be seen, on December 21 there was a strange scarcity which we were at a

loss to explain. There had been a fire in a tanker in the Arthur Kill the day before. Some gasoline had been spilled into the water and, although the oil company claimed that most of it evaporated, there might have been some damage to ducks, grebes, loons, and geese. Or perhaps it was a blessing that they were conspicuous by their scarcity in numbers at this particular time. The bird watchers did not spot any big oil slick, but birding could not be done in the immediate area anyway since the approach to the shore at this point is almost impossible.

At the Benjaminsons' feeder (Great Kills) there appeared, just in time for the count, an *albino Cowbird*, all snowy white with a flesh-colored bill and pink legs. The Benjaminsons were very excited and the bird came back later in the day to be seen again. It was flying with a group of fourteen other Cowbirds.

In Clove Lake, which had been drained, 29 Common Snipe were probing the mud with their long bills. This was a very high count for snipe. They blended so well with the tin cans rusting in the mud that without the use of a telescope we would not have been able to spot them. There were also twelve Killdeer, a far larger number than ever before in this lake.

The Yellow-bellied Sapsucker reported last year for the first time on the count was in a maple tree next to the pine in which he was seen last year.

There were all-time high counts in the following species: Brant, Rough-legged Hawks, Ruddy Turnstones, Purple Sandpipers, Mourning Doves, Mockingbirds, Robins, Starlings, Evening Grosbeaks, Pine Siskins, and Savannah Sparrows.

Rarities seen were: Virginia Rail (a recorded first for this time of the year), Winter Wren, Bluebirds, Ipswich Sparrow, Lapland Longspur, and the Red Crossbills which were the first of this species seen on the Staten Island census since 1931, making only the fourth recording since the beginning of the census.

The high count of gulls and hawks can be attributed to the extension of the garbage dump through the sanitary land-fill program.

The observers were: Doris Barlow, Philip and Mary Benjaminson, Stanley Caufield, Howard Cleaves, Robert Clermont, Charles Fallon, Howard Fischer, Gregg Loan, Tom Matterfis, Anna Meyer, Celia Polomany, Eddie Stonick, John Stonick, and Mathilde Weingartner, all from the Section of Natural History.

Manuel Arias, Edward and Lana Mills, Herbert Kaltman, and Esther Swayer from the Brooklyn Bird Club.

Charles Pearson from New Jersey.

<i>Listing of birds seen:</i>		Yellow-bellied Sapsucker	1
Horned Grebes	78	Hairy Woodpecker	1
Great Blue Heron	3	Downey Woodpecker	52
Black-crowned Night Heron	17	Horned Lark	63
Brant	61	Blue Jay	35
Mallards	228	Common Crow	225
Black Ducks	353	Black-capped Chickadee	84
Green-winged Teal	3	Tufted Titmouse	17
American Widgeon	7	White-breasted Nuthatch	19
Wood Duck	1	Red-breasted Nuthatch	5
Canvasback	15	Brown Creeper	1
Greater Scaup	3,661	Winter Wren	1
Common Goldeneye	125	Mockingbird	38
Bufflehead	254	Catbird	1
Oldsquaw	86	Robin	44
White-winged Scoter	2	Hermit Thrush	2
Common Scoter	3	Eastern Bluebird	2
Common Merganser	1	Starling	18,018
Red-breasted Merganser	3	Myrtle Warbler	5
Red-tailed Hawk	9	House Sparrow	327
Rough-legged Hawk	16	Eastern Meadowlark	10
Marsh Hawk	4	Redwinged Blackbird	220
Sparrow Hawk	16	Rusty Blackbird	14
Ring-necked Pheasant	43	Brown-headed Cowbird	54
Virginia Rail	1	Cardinal	73
Killdeer	12	Evening Grosbeak	8
Black-bellied Plover	1	Housefinch	15
Ruddy Turnstone	74	Pine Siskin	132
Common Snipe	29	American Goldfinch	17
Purple Sandpiper	165	Red Crossbill	11
Dunlin	1	Rufous-sided Towhee	5
Sanderling	24	Savannah Sparrow	20
Great Black-backed Gull	10,625	Vesper Sparrow	1
Herring Gull	54,629	Slate-colored Junco	142
Ring-billed Gull	377	Tree Sparrow	172
Laughing Gull	16	Field Sparrow	12
Bonaparte's Gull	1,401	White-throated Sparrow	235
Mourning Dove	395	Fox Sparrow	18
Screech Owl	1	Ipswich Sparrow	1
Long-eared Owl	1	Swamp Sparrow	3
Short-eared Owl	4	Song Sparrow	180
Belted Kingfisher	3	Lapland Longspur	5
Yellow-shafted Flicker	15	Snow Bunting	16

The Waterbird Count, taken on January 17, 1970, reflected the three weeks of cold weather that preceded the day of the count. Upper Bay was choked with ice floes, Lower Bay had sections frozen over, Raritan Bay also had areas of ice, and the Great Kills Yacht Basin was completely covered with ice. Gulls rested on much

of this ice but the ducks seemed to avoid it. Many of the creeks and brooks were also frozen.

Compared with the time of the Christmas Count, there had been a reduction in the number of ducks, especially the large rafts of Scaup which seemed to have disappeared.

The count was taken by Howard Fischer, Howard Cleaves, Anna Meyer, and Mathilde P. Weingartner.

A lone Casvasback Duck was found near Outerbridge Crossing in almost the same place this species had been spotted in December. Another good find was a Pintail seen by Anna Meyer near Wolfe's Pond Park. Because other birders met in the area of Wolfe's Pond Park had seen a Shoveler Duck and had pointed out its location, this bird was also added to the list, an unusual find for Staten Island.

List:

Horned Grebe	1
Brant	41
Mallard	216
Black Ducks	508
American Widgeon	9
Shoveler	1
Pintail	1
Canvasback	1
Greater Scaup	992
Common Goldeneye	380
Bufflehead	107
Oldsquaw	2
White-winged Scoter	1
Red-breasted Merganser	3

Totals:

Species = 14, Individuals = 2,263

College Students and the Institute

The Staten Island Institute of Arts and Sciences has, since 1966, been one of the cultural institutions in the City which benefits from participation in the Urban Corps' Program. This program was started in that year under the supervision of Dr. Timothy Costello, then Deputy Mayor, and is best described as a major-oriented program offering off-campus work related to a student's field of study which provides him with a source of funds to help him stay in college and graduate. Over the four intervening years the Institute has welcomed the participation of 47 students as part-time interns from various colleges. In the great majority of cases their work has added to the ability of the Institute to function. In addition to the concrete on-the-job achievements these students have made, the experience has often been a positive one for our staff as well. Cultural institutions which have a history of any duration or tradition of work within the community offer stability achieved through long-term slow growth. These institutions should serve as a bridge between the student and the academic life, and through the medium of the training of interns a modicum of stable background, a chance to grow, another way to "touch base," are offered to the student, while providing a relativity between tradition and contemporary life. Such interaction between a college and a community cultural institution allows the student a means of achieving greater personal perspective. That this has happened is proven by the students who have kept in touch with the Institute and have reflected influence from working within the Institute.

The report that the City University is considering the creation of a new academic degree which is planned to give students greater freedom in designing their own scholastic programs, and which would include one year spent working for a city, state or federal urban agency or institution in an attempt to provide real experience along with education and theory, might be said to be a logical out-growth of the Urban Corps intern-program. We would support Dr. Bowker's proposal which is to be placed before the Board of Higher Education for consideration, because this program represents a formalization of what we have already done over the past few years.

For the Summer of 1970, the Institute set up three team projects: (1) *An Archaeological Dig*, which was the continuation, under the Institute's aegis, of a dig which has been in progress for one-and-one-half years with teams from NYU, CCNY, and Columbia. (2) *The History of the Black Man on Staten Island*, a project which has been suggested by the Institute for some years, but which for various reasons has not yet been funded. (3) *The Staten Island Ecology Action Center*, in the community of Tompkinsville, on Victory Boulevard.

All three programs were to be student-directed with over-all supervision from the Institute. These programs involved, for the summer only, a total of 28 students.

The interim reports from the second and third projects are excerpted here as follows. The Archaeological Dig Report will be printed in the future, when all laboratory findings and correlations with earlier work have been completed.

As Coordinator for Urban Corps' students within the Institute, as well as Editor, my assessment of their work follows the students' reports.

The Black Man on Staten Island

A report prepared by Clyde Ayers, Marianne McGovern, Deborah McGrath, Jean Martin, Carmen Simon, Paul L.

Trapp, Sharon Van Willis, and Pamela Vincent

This interim report has been written to provide information as to the extent of the research as of this date; also, to provide the guidance for the continual advance of this important study.

The project, this summer, has been a student directed research activity combining the varied talents of the researchers and Neighborhood Youth Corps in a learning experience. College students and High School students profited from this experience because of the personable relationships formed and the concept of team work fostered. The senior students taught the high school students how to use the tools of research and individual study. Participation within the Staten Island community gave the students from other areas fresh insights and understanding into the provincial character of the Staten Islanders.

INTRODUCTION

Purpose: A team project designed to provide the initial impetus toward compiling a "History of the Black Man on Staten Island"

Organization: The members of the project consisted of a core of eight Urban Corps workers, all Richmond College students with various academic interests.

This core was aided in our research work by a group of twelve Neighborhood Youth Corps workers. We feel that the diversification in academic backgrounds as well as cultural backgrounds added to the objectivity and scope of our research techniques.

The two groups, after receiving orientation instruction and general conceptual guidelines, were able to proceed as several different teams. The teams utilized a random research approach: random because we started with a basic overview of history and tried to provide the foundation for the eventual in-depth study of the history of the black man on Staten Island.

Methods: The teams proceeded to collect information from local organizations, to interview persons involved in the black community of the Island and to utilize the material made available by the Institute. The teams made use of the following sources and the results there of:

SOURCE—MATERIAL FOUND THEREIN—STATUS

Staten Island Historical Society—books, bills of sale for slaves; wills, deeds, genealogical records. Research completed.

Richmond College Library—books and *The New York Times* microfilm. Research completed.

St. George Regional Center—books. Research completed.

Schomberg Collection—books, early black New York newspapers on microfilm. The newspapers have not been completely reviewed.

Staten Island Institute of Arts and Sciences: History Library—books, microfilms, reference folders, periodicals, personal collections, wills, deeds, genealogical records, church records. Research completed.—Early volumes of Staten Island newspapers on microfilm. Completely reviewed and relevant material extracted. (The Institute is a major source of Staten Island and New York historical material.)

Richmond County Clerk's Office—wills, deeds, census records for 1855 through 1875 inclusive. Research completed.

Interviews for compiling oral history—interviews with private citizens, leaders of civil rights and social organizations. Twenty interviews on various subjects were recorded on cassettes and copies made by typewritten transcriptions. More interviews need to be arranged and completed.

Cemeteries—Sandy Ground cemetery, surveyed and plotted. The other cemeteries in the area have to be surveyed and plotted.

Funeral Homes—Billops and Chambers Funeral Homes must be visited to see if records are available.

Church Records—the early, established Protestant Church records were reviewed. The records of the Roman Catholic Church and those of contemporary black churches, both established and storefront, are still to be examined.

Materials collected and their arrangements:

A. Folder files with more than seven hundred items of information on various subjects have to be correlated, catalogued and indexed.

B. Two files of index cards:

I. a master file—on individuals with and without surnames which is based on church records (births, baptisms, marriages, deaths) and information gathered from records at the Staten Island Historical Society regarding deeds, wills, and bills of sale for slaves. The purpose of the file containing 5000 cards is to provide a reference to the early black inhabitants of Staten Island.

II. a master file on families based on census records from 1855 to 1875 which included the names of all members of the households, their age in consecutive census, their occupations, their place of birth and the town in which they live. This file provides a concise record of households, on a secular level, for a twenty-year period.

C. A file of tape cassettes and the typewritten transcriptions of each interview conducted has been established. This file contains the vital oral history source material for further study. The project plans to utilize the interviews as a basis for establishment of the modern black history. We interviewed with the rationale that the "history is the people." We did not attempt to guide or structure the oral history. The furtherance of this phase of the project must understand this essential procedural philosophy and carry it forward.

Conclusions:

The random method of research we have utilized will provide the essential basis for the continuing research into specific areas of Black Man on Staten Island. We feel that the project is ready to continue into those areas of special emphasis that are necessary for a complete history. The present team has definite ideas as to the progressive study of the history. We look forward to the continual study of the History of the Black Man on Staten Island. The present team will publish several papers concerning the studies. Special thanks is extended to the Neighborhood Youth Corps workers.

Assessment: The Interim Report outlines the tremendous work achieved by these students during a short summer work period. The Institute has urged their return to this work, complete as a group. As of October 1st, this had not materialized. The students have shown that the material is there to be assembled, but the work they have done, although a great achievement, is just the beginning of the project. They themselves are in the best position to recognize this.

As to their methods of work, their cooperation among themselves and with the Neighborhood Youth students, much could have been learned through observation by older people of the ways in which these students with varying backgrounds, interests, abilities, and ages worked in the most positive and integrated manner.

The Institute is proud of this summer's work and proud of the students who helped the Institute to achieve a beginning in this historical investigation.—G.K.S.

Staten Island Ecology Action Center

Excerpts from an Interim Report

by John Odenthal

"Since man discovered fire, used a weapon and invented the wheel, he has advanced farther and farther away from nature and its own checks and balances. . . . Ergo the Ecology movement. Its precepts: 1) *Living things have organized themselves into eco-systems*; communities of mutual dependence and support. 2) *Every living thing is part of an eco-system*. 3) *Nothing can be thrown away, really. Everything has to go somewhere*. 4) *Nothing is free*. The Earth's resources are finite. 5) *Human beings are not the center of the global eco-system*. We depend on a wide variety of species for survival, while almost no species depend on human beings for survival. . . . Ecology Action is the beginning of a total, rapid, non-violent transformation of our values, economy, politics, and life styles.

"What was to become Staten Island Ecology Action grew out of the coals of a small energetic organization called S.C.A.R. (Students for the Conservation of America's Resources) . . . Mr. George Pratt, . . . Director of the Staten Island Institute of Arts and Sciences, an institution which for years has led the fight to conserve the Island's dwindling wildlife, acted on the proposal" to open a storefront center on the Island; and a storefront "in a nearby commercial district, on a main thoroughfare, in a rather impoverished neighborhood" was rented. "The financial state of the neighborhood had a subtle effect on the tone and scope of the center's activities. . . .



Members of the Staten Island Ecology Action Center prepare trash for collection outside their headquarters at 76 Victory Boulevard, Tompkinsville. They are, left to right, Lindsay Martin, Maureen McAllister, and Shelley Landers. (Photograph reproduced, courtesy of The S.I. Advance. Photo by Frank J. Johns.)

"We realized quickly the whole project was to be only what we could make it. With a newly-aroused populace, and agonizingly few organizations to take example or direction from, we had to formulate and implement from scratch a program that would: a) Inform Staten Island of its ecological plight, and (b) Suggest and/or initiate concrete alternatives to the present course.

"A bit stunned by the potential scope of the project, we managed to formulate a simple but activist program:

"1) A Newsletter—distributed in all communities—toned to virtually all interests.

"2) Investigation teams—sent to the site of complaints, prepared to measure and record any eco-cidal activities. 'We welcome complaints.'

"3) Research groups—to 'watch' potential polluters and to visit agencies and resource centers to develop best means of dealing tactically, legally, and educatively with polluters.

"4) Community action—working with communities and neighborhoods trying to organize clean-ups, vacant-lot conversion, and any local environmental projects.

"5) Information and Referral Center—simply to put those concerned about our environment in touch with those like-minded. Possibly a booth in the Staten Island Ferry terminal along with this Center to help disseminate information.

"After some indecision, we chose the name 'Staten Island Ecology Action Center' for ourselves: '*Staten Island*,' because we wanted Islanders to identify with our cause, and concentrate on local activities; '*Ecology*,' because we were about more than just 'conservation' or 'anti-pollution,' or any such one-dimensional program; '*Action*,' because we knew it was now the time for action, although we weren't sure just what form it would take. . . . Indirectly, we realized we were both a '*Center*,' a place within which to confront visitors concerning the state of the environment; and a headquarters, and organization, distinct but attached to the center. . . ."

The second week of its existence the Center published its first newsletter which was continued fairly consistently throughout the summer. Trips and tours of Staten Island's polluted environment were taken of which slides and photographs were shown at the first open house to which many Staten Islanders were invited. Community action was initiated as complaints regarding littered beaches and lots were heard. The Center became a focus of information and education through discussion, films, and meetings at which specialists in pollution were heard, and action engendered.

“‘Recycling’ was a practice I’d first heard of on Earth Day. Simply, there are only so many resources available on Earth. Waste consumes these resources and returns nothing. Only humans do this. So there is an urgent need to re-use, or ‘recycle,’ these materials. We began humbly by saving all the cans and bottles used at the Center, which amounted to quite a few, since we were ‘pepsi-generation’ consumers at heart. Soon, Lindsay Martin had formulated some general plans for an Island-wide recycling program. We distributed leaflets, put up posters, and sat back as people responded almost instantly and began dragging into the Center cans, non-return bottles and paper. . . .

“So, our Community Action program led us down varied avenues. We found ourselves directly involved in the introductory meeting of a proposed Community Planning Board. And on another occasion some of us attended an open meeting of an ad hoc group called Citizens Against Bus Exhaust (C.A.B.E.). . . .

“Simultaneous with our activities inside and outside the Center was our fight for financial security. Ecology we fairly understood, but we proved to be amateurs at fund raising. Our recycling program would not be given any monetary return until late September. The nickels and dimes from our contribution box barely paid for office supplies. We were lucky enough to work out an agreement with Richmond College to borrow (one day at a time) a film projector and tape recorder. We desperately need this equipment on a full-time basis. Some of the best ecology films are quite cheap to rent but we couldn’t afford a single one. We have some experienced film-makers at the Center, but little hope of getting equipment. A film on Staten Island’s Environment would be a powerful tool in reaching the populace.

“About mid-summer during a lull in activities we took some of the Y.E.S. children and made a walking tour of the Island’s ‘Green-belt.’ It was a shot in the arm; we discovered polluted ponds in the midst of the beautiful woodlands. This excursion gave us a new impetus and new urgency. Our commitment was strengthened.

“To reach the Island community we obtained a permit and began building an information booth in the Staten Island Ferry terminal. The booth, attractively designed by a member who was an architecture student, was the first such set-up allowed in the terminal in years. . . .

“By now, we were dispersing energy in very many directions. Involved in sundry projects, we took on yet another.”—From the local City Planning Commission office. These were only a few of

the highlights provided by ten weeks of work by thirteen Urban Corps Students, supervised by Shelley Landers, herself just graduated from high school, and John Odenthal, graduating senior student at Richmond College, who volunteered his time. His summary concludes:

"This is our experience up to now. I don't say 'progress,' partly because the 'progress-is-our-most-important-product' mentality is a prime contribution to the Earth's Environmental destruction. Purely linear measures of advancement must be criticized. We didn't move far forward in one direction, as much as we moved simultaneously in many, increasing our awareness of the interdependence of all living things, and the necessity to create environments that alter nothing of the ecological balance. We continue to try to live the slogan: *'Everyday is Earthday.'*"

Assessment: The energy generated by these students has lasted over into the Fall. The students will not let the program die, and have worked to guarantee a new staff of eight students who have been assigned through Richmond College and the Urban Corps to continue activities. Recognizing the need for funds, they have expedited their activities continuing to speak before service groups on Staten Island. A major effort is being built around a teach-in on October 14, 1970, at S. I. Community College which will culminate in a rock concert to raise funds to continue the work of the Center. The dialogue which has developed through this program between community citizens and students is continuing to provide healthy, mature activity and cooperation.—G.K.S.

Natural History Records

Prepared by MATHILDE P. WEINGARTNER

From the beginning of the Natural Science Association of Staten Island's publications, the minutes of the naturalists associated with the organization were included in the Proceedings, providing a continual record of Staten Island nature observances. Later these records were included in the Annual Reports of the Institute.

When the Section of Natural History was formed in 1945 as a successor to the Bird and Nature Clubs this valuable service was dropped. Staten Island Nature Notes would have been lost to posterity unless something was done. Subsequently Lee A. Ellison abstracted the Nature Section's minutes and field reports to make a publishable record of the highlights. These abstracts were printed in the Proceedings, the final series of abstracts (Fall 1954) being provided by Robert A. Mathewson, then Curator of Science for the Museum.

To restore this valuable service, Mathilde P. Weingartner, Curator of Science, has taken on the responsibility of the Records and has supplied the Proceedings with abstracts from August 1954 through January 1970. The abstracts through 1960 are published as follows. The balance of the abstracts will appear in successive numbers of the Proceedings.

ABSTRACTS from the Minutes, Field Trip Reports, and
Study Group Minutes of the Section of Natural History
Code: F.T. = Field Trip Reports
S.G.M. = Study Group Minutes
W.L.R. = Wild Life Refuge
C.R. = Confidential Records

No letters after date = Section of Natural History Minutes

Plants

Allionia nyctaginea—Ward's Point—J. LeMaire, 9/57 F.T.

American Chestnut—Ellison, 9/58; 8/60

Ampelopsis brevipedunculata—Ellison, W.L.R. 11/56 C.R.; 10/58
S.G.M.

Arrow Arum—Grasmere Bog, 7/58 F.T.

Bald Cypress—Elkin, Bay St., 10/55 S.G.M.; 8/59
 Big Trees of Staten Island—Rundlett, 4/53; 11/58
 Carolina Poplar—Plum, Tottenville, 4/59
 Christmas Fern—Ellison, Bloodroot Valley, 6/55 S.G.M.
 Closed Gentian—Ellison, Buck's Hollow, 10/57 S.G.M.
 Ebony's Spleenwort—Ellison, Bloodroot Valley, 6/55 S.G.M.
 Foxtail Clubmoss—Ellison, Buck's Hollow, 10/57 F.T.
 Indian Pipe—Grasmere Bog, 7/58 F.T.
Lotus corniculatus—Mount Loretto, 8/56
 Maidenhair Fern—Ellison, Bloodroot Valley, 6/55 S.G.M.
 Partridge Berry—Travis, 4/59 F.T.
 Petrified Wood—Mathewson, Midland Beach 2/57 S.G.M.
Pogonia verticillata—C. Taylor, Eltingville, 5/57
Quercus heterophylla—M. Weingartner, Clove Lakes Park, 2/59
Ranunculus aquatilis—Cooper, Clove Lakes, 5/57
 Staghorn Sumach—Ellison, Latourette Park, 10/57 F.T.
 Turk's-cap Lily—Taylor, Buck's Hollow, 6/58 F.T.
 Virginia Pine—Rossville, 6/59 F.T.
 Wild Ginger—Travis, 4/59 F.T.
 Yellow Pine—Ellison, 9/58

Weather and Astronomy

Aurora Borealis—M. Weingartner, 2/58
 Comet—8/57
 Echo I—Burke, 8/60
 Ice Bow—Mathewson, 2/56 S.G.M.
 Northern Lights—G. Loery, 3/56 S.G.M.
 Mutnik—Braun, 3/58 S.G.M.
 Sputnik I—Redjives, 10/57
 Sputnik III—M. Weingartner, 7/58
 Sundog—Taylor, 7/57, 9/60
 Sun Spots—Burke, 7/57

Marine Life

Anadonta grandis—Clove Lakes Park, 2/59 F.T.
Epitonium rupicolum—W. Loery, Ward's Point, 10/55 S.G.M.
 Fish (*Lophius*)—Betros, Ward's Point, 12/58
 Glossy Lyonsia—Le Maire, Great Kills Park, 12/56 S.G.M.
 Sea Horse—Elkin, 4/55 S.G.M.
 Sharks—Mathewson, New York Bay, 9/60
 Shells from Ward's Point—9/57 F.T.

Amphibians and Reptiles

Molley-Turtle—Mathewson, 3/59

Lead-backed Salamander—Travis, 4/59 F.T.

Black Racer—Meyer and Loery, Forest Hill Road, 9/59

Insects

Ants—Allegheny Mound-Building—Buck's Hollow, 6/58 F.T.

Beetle (*Spaeroderus lecontei*)—W. Loery, 6/56 S.G.M.

Beetle on Yucca—W. Loery, 6/58

Black Widow Spider—M. Weingartner, Livingston, 10/58

Caterpillar Hunter—Taylor, 9/57

Chrysis coerulans—Cooper, 8/57

Gibbium psylloides—Cooper, 8/57 C.R.

Megaphysa atrata—Cooper, 9/57

Megaphysa lunata—Cooper, 9/57

Polyphemus Moth—Anna Meyer, 9/58

Prionus laticolis-Beetle—Betros, Tottenville 7/60

Pseudoscorpion—M. Weingartner, W.L.R. 5/56; S.G.M. 5/60

Tremex columba—Cooper, 9/57

Birds

Alder Flycatcher—M. Weingartner—W.L.R. 5/57; 6/58

American Bittern—Bogardus' Pond—8/56 F.T.

Avocet—Ellison at Travis—9/55 S.G.M.

Barn Owl—Eltingville—6/60 S.G.M.; /55 F.T.; W.L.R. 4/56; S.G.M. 12/58

Black-headed Gull—Redjives at Ward's Point—11/56

Black Tern—LeMaire at Ward's Point—8/57 S.G.M.

Blue Goose—A. Meyer—10/59

Blue-Gray Gnatcatcher—Clove Lakes Park—F.T.

Bobolink—Cleaves at Mt. Loretto—5/57; 5/59

Bobwhite—R. Meyer at Livingston—5/61 S.G.M.

"Botulism in Birds in New York Bay"—B. Cook—9/57

Brown-capped Chickadee—LeMaire at Moravian Cemetery—5/55 S.G.M.

Canada Goose—Wolfe's Pond Park by E. Corey—10/58; 11/58

Carolina Wren—LeMaire at Moravian Cemetery—2/56 S.G.M.; 10/56 S.G.M.; 12/56 S.G.M.; 6/58 S.G.M.

Caspian Tern—Von Bevern at Great Kills—9/60

Common Egret—Bogardus' Point—8/56 F.T.

Common Eider—Redjives at Wolfe's Pond Park—11/56

Evening Grosbeaks—E. Schleich—Great Kills—11/58; 1/60

Glaucus Gull—Ellison at Travis—3/56 S.G.M.
 Golden-winged Warbler—M. Weingartner at Moravian Cemetery
 —5/57 S.G.M.
 Hoelbell's Grebe—Redjives at Wolfe's Pond Park—11/57
 Hooded Merganser—Redjives at Wolfe's Pond Park—11/56; 3/57
 Hudsonian Curlew—M. Weingartner—Great Kills—5/57
 Ipswich Sparrow—Redjives at Wolfe's Pond Park—11/56
 Kumlein Gull—M. Weingartner—12/57
 Little Blue Heron—Bogardus' Pond—8/56 F.T.
 Magpie—D. Hunt at Mt. Loretto—4/56 S.G.M.; 12/58
 Mockingbird—LeMaire at Moravian Cemetery—3/57 S.G.M.; 2/58
 S.G.M.
 Mute Swan—M. Powell at Eltingville—1/60 S.G.M.
 Orchard Oriole—Mathewson at Tottenville—9/55 S.G.M.
 Piping Plover—G. Loery at Ward's Point—6/56 S.G.M.
 Prothonotary Warbler—M. Weingartner at Moravian Cemetery—
 5/57 S.G.M.
 Red-bellied Woodpecker—M. Weingartner at Moravian Cemetery
 —4/60
 Redhead—M. Weingartner at Willowbrook—11/55 S.G.M.
 Red-headed Woodpecker—Ellison at Muldoon Avenue—4/57
 Redpoll—D. Hunt at Moravian Cemetery—4/56; Grimes at Gras-
 mere—3/60
 Red-tailed Hawk—Richmond—3/60 F.T.
 Rough-winged Swallow—Lemon Creek—7/56 F.T.
 Saw-whet Owl—Burke at St. George—3/55 S.G.M.; 3/58 S.G.M.
 Short-eared Owl—Redjives at Great Kills—11/56
 Snowy Egret—Bogardus' Pond—8/56 F.T.
 Snowy Owl—M. Weingartner at Great Kills—12/60 S.G.M.
 Sora Rail—G. Loery at Greenridge—9/55 S.G.M.
 Tufted Titmouse—Ellison at Eltingville—4/57; 11/57 S.G.M.
 White-eyed Vireo—G. Loery—W.L.R.—6/55 S.G.M.
 White-winged Crossbill—Whitehead at Emerson Hill—2/60
 Yellow-breasted Chat—M. Weingartner—W.L.R. 4/59 S.G.M.
 Yellow-crowned Night Heron—G. Loery at Lemon Creek—6/56
 S.G.M.

BOOK REVIEWS

"The Road to Ruin" by A. Q. Mowbray, Lippincott. \$5.95

A. Q. Mowbray takes up in turn all phases of the problems created by highways, as some of his chapter headings suggest: The Asphalt Shroud; A Man's Home Is His?; Erosion of the Cities; White Roads through Black Bedrooms; A Question of Balance, Highways or People. The book is not merely a book against the proliferation of highways, but a study of how we are ruining our environment both natural and urban by our blind response to economic and political incentives and pressures generated by an unlimited source of tax money available to build roads to accommodate the cars which are the ultimate gratification of the average American's urge to individual power, freedom and mobility.

Mowbray shows not only that the natural beauty of the countryside is despoiled and the natural environment rendered unfit to support life wild or human, but the urban environment is also being rendered untenable.

Our obsessive subservience to the needs of individual motor transport is at the bottom of many urban problems such as air pollution, noise, traffic congestion, and parking problems. Deterioration of mass transport—trains, subways, and buses—is accompanied by an increase in auto traffic which destroys the flexibility and ease of individual transport.

Mowbray contrasts the handling of the urban environment in European cities with our commercial exploitation of the approaches to American cities. He particularly notes the inviolate green belts to control urban sprawl around Great Britain's cities. He also contrasts the European nations' development and improvement of mass transport in the cities with our neglect of these facilities. For instance, when subways which are now under construction are completed, West Germany will have as many subways as there are in all of the United States.

He details the decay of our railroad passenger service and traces the effect of this deterioration on the economic health of cities and on the unrestrained proliferation of motor cars and roads.

He analyzes and clarifies with terrifying precision the powerful, Hydra-headed forces at work to produce the "urban sprawl" which blights our Eastern states and practically every other growth area across the nation.

In city after city carbuncular ghettos of poverty form at the core while a pus of exploitative, unplanned, unregulated urbanization forms an aureole of dying countryside around it. Truly, an observer in low orbit might say the face of this country is covered with boils. Mowbray not only points out the source of infection, but suggests remedies, such as pedestrian malls, and special express lanes designated for trucks, taxis, and buses, the movement of which are in the public interest.

Mowbray exposes the fallacies perpetrated by reasoning on too narrow a basis when justifying the "adaptation of the cities to the demands of the automobile," and points out the dire consequences of not adapting our cities to the needs of the humans who live in them.

This is in some ways a wonderfully readable book, with vignettes of idyllic urban as well as rural life, but these are often the prelude to Dickensian episodes of little people's lives crushed and pushed aside by the inexorable crunch of a bulldozer's blind progress. ". . . our failure is not in our methods of [systems] analysis, but in our values that put the machine first and man second." One does not need to read many of the case histories cited in chapter 9, "Your Highway Taxes at Work," to feel the only possible way to fight successfully the location of a proposed highway would be to hire bulldozers and engage in armed combat with the highway bulldozers.

"In his testimony at the Ossining hearings, John G. Mitchell, chairman of the Staten Island Greenbelt Natural Areas League, questioned the 'sincerity of the state in its proposal to combine this truck route with a waterfront park—built, incidentally, on fill into the river in total disregard of the river's delicate ecology. The paradox of picnic tables and passing trucks is all too familiar to us. The state recreation planners also envisioned such incompatible uses for the Staten Island greenbelt—a hiking trail, if you will, 70 feet from a 55-mile-per-hour parkway!'"

Local readers of this review will be interested also in a quotation from historian Mabel Abbott, to be found in chapter 9.

This is not great literature, but it is very readable, good, expository reporting—alarming as a war report on a battle entering a critical stage—which, indeed, is truly what it is. This book was written to make clear the nation-wide scope of the battle. In the light of this book our struggle to preserve the scenic areas on Staten Island can be seen as the local phase of a fight going on in our national parks, in and around every sizable city, in many small towns and in practically every corner of the nation.

This book makes very clear the catastrophic nature of the changes we are making in our environment. It shows how in our automatic, machine-centered response to the demands for highways—urban, arterial, and transcontinental—we are violating the laws of ecology to which we are subject like all other living creatures.

As I read this book, there came to my mind the story of the Sorcerer's Apprentice, who found his master's book of formulas and set a broomstick to work drawing water to fill a cauldron. When the cauldron was full he found he could not stop the broomstick from flooding the house with water. In desperation he smashed the broomstick to bits, only to find that each bit and splinter soon went busily to work to pour more water in an unending stream into the overflowing cauldron. Of course the United States is a much larger proposition than the Sorcerer's castle, but Mowbray discloses in his second chapter how three presidents and a succession of senators and congressmen found a formula by which taxes on gas and tires and other motoring necessities pour an unending stream of money into a fund reserved for highway construction and no one in the world can stop it from being poured out for highway construction whether needed or not.

The Road Gang, Mr. Mowbray's term for the Federal Bureau of Public Roads, which administers the Highway Trust Fund, is a self-perpetuating, unregulated, publicly financed agency dedicated to the single-minded production of more and more miles of public roads, and unconcerned with social costs.

The author might well write a sequel to show us what we are doing to the natural world, how we are in our ignorance tearing apart the web of life, which alone makes it possible for this globe to support us. —CARLTON BEIL

"The Best Nature Writing of Joseph Wood Krutch." William Morrow, 1969. \$8.50.

"With the death of Joseph Wood Krutch in Tucson, Arizona, on the 22nd of May, one of the most eloquent and thoughtful voices in our environment has been silenced." In deep sadness this was noted by the Board of Directors in *Defenders of Wildlife* about their sponsor and friend.

This voice may be heard in all its eloquence by the reader as he savors *The Best Nature Writing of Joseph Wood Krutch*. This last book of the author's is a collection of 34 essays which he

selected and introduced. When this critic, journalist and teacher turned to nature writing some 20 years ago he did so, he explained, to pass on to others the delight and joy he had experienced from reading such writings. Joy floods the book, the joy Krutch felt when he viewed nature's creations and the joy he felt was a distinguishing characteristic of all animal life. But the very delicate knowledge that Krutch mirrored throughout this collection was a consolation he happily shared, that we are all in this together. "All" meant the *Hyla Crucifer*, spring's first peeper announcing the time was ripe that "Christ was risen," the sea squirt who found a crevice in which to hide when she preferred to have evolution pass her by, the kangaroo rat which has been able to survive in the desert by manufacturing its own water, and even man, all who share life.

Krutch spoke of the deep loneliness which would envelop man if he succeeded in conquering nature, which seems to mean eradicating it, and if he were left as the only living creature in the coldness of the planetary system. This literary man's faith in nature's processes was deep, and speaking of the pessimistic predictions of man's doom, he presented an interesting alternative. Perhaps the way to a higher creature is not through man, he speculated, but if man extinguishes himself, perhaps nature has another course. The thought seemed strangely comforting and placed man back where he belonged, as one part of nature.

The author's acquaintance with earlier philosophers' and writers' views of man's relationship to the natural was vast. He compared Descartes' aberrative notion that because other animals have no souls they have no consciousness with Alexander Pope's poem from his "Essay on Man."

"Hast God, thou fool! work'd solely for thy good,
Thy joy, thy pastime, thy attire, thy food? . . .
Is it for thee the lark ascends and sings?
Joy tunes his voice, joy elevates his wings."

Krutch seemed to repeat most often the tenets of John Ray who wrote a generation before Pope that man is unique because he alone is capable of observing, understanding and admiring the infinitely complex world of nature which God created.

Everyone concerned with man and his relationship to his environment will appreciate the author's revealing so much of himself in *The Best Nature Writing of Joseph Wood Krutch*. His own philosophy of nature, informed and enriched by a broad literary understanding, is a treasure. The tales of his observations of nature are informative and amusing. The fun he had when an aristocratic

strain of laboratory mice, which he was tending for one of Columbia University's laboratories, went slumming with some commoners from his wainscoting is related with fine humor.

Conservationists were advised by this nature lover and ecologists were admonished. They might ponder his description of man as waster of earth's resources and creator of "the most prodigious imbalance in the natural order which has ever existed." They were warned, moreover, that any real management of resources is impossible unless we realize that there is a conflict between what is called the general good and a good still more general—the good of the whole biological community.—DOROTHY KRIETE

BOOKS NOTED

In the past few years the literature describing, predicting, and bemoaning the environment's changes has added its own bulk to the "information explosion." The layman is confused and the librarian overworked (especially when trying to fit such material into the Dewey Decimal System). And of course let us not forget increases in deforestation, water and air pollution, ironically enough the very effects the books rail against.

It may become necessary to set up a judicious yardstick to help the writer on environmental and ecological catastrophes and to avoid increasing thereby the problems of the Earth. It is obvious for the past year or so that the usual stale priorities have been at work here: a new bandwagon arrives and in the spirit of Madison Avenue all hop on, whether or not they understand the bandwagon's message enough to interpret it.

We have seen and read many of the past year's treatises and have some suggestions for such a yardstick. To take the measure of the books and the other publications which the layman especially (the scientist we leave at the moment to his own devices, hopefully he is able to care for his needs), would benefit from as well as enjoy, we suggest in this issue several titles which make up at least a foot of the yardstick, the two reviewed separately above plus the following publications:

"The Hudson River: A natural and unnatural history" by Robert H. Boyle. W. W. Norton & Co., 1969. \$6.95.

"Lost Heritage: Wilderness America through the eyes of seven pre-Audubon naturalists" by Henry Savage, Jr. William Morrow & Co., Inc. 1970. \$10.00.

"Since Silent Spring" by Frank Graham, Jr. Houghton Mifflin Co., 1970.

"Terracide: America's Destruction of her Living Environment" by Ron M. Linton. Little, Brown & Co., 1970. \$7.95.

Environment, published ten times a year. (Formerly published under the name of *Scientist and Citizen*.) 438 N. Skinker Blvd., St. Louis, Mo. 63130. \$8.50 per year.

"The Hudson River" is, first of all, an enjoyable experience in reading, whether or not the reader is a New Yorker and familiar with the Hudson. Secondly, the essence of human ecology is sampled in this book: the people who live on and by means of the river. These individuals, because of their intimate knowledge of the river, recognize the disaster the continued depredations will mean. Such people, as a matter of fact, will disappear from the earth if the river and its unique environment goes. The human race will be that much the less for this loss. Storm King Mountain and the proposed expressway along the river's shore are not only attacks on nature, biology, water, and the striped bass, but also upon people. Lastly, the author chronicles the tactics by which these individuals have fought back to save their environment. Although they have lost sometimes, they have also won sometimes. The lesson is that individuals elsewhere can do the same. (Kurt Vonnegut would appreciate these river people!)

Henry Savage's book is beautiful, in the way it is designed, formatted, printed, and presented, and in its prose. It is also a sad book, as it vignettes the lives of these early naturalists and draws upon their writing to offer a fleeting vision of early wilderness America in contrast with today's "concrete jungle."

Rachel Carson, who is still damned and blessed today, was supposed to have started "all this," according to those who thought she should have remained silent. But Rachel Carson, disliking the possibility of silenced nature instead, wrote her landmark book, "Silent Spring," which indeed exerted major influence in the decade since its publication. Her friend, Frank Graham, Jr., assesses the changes and the tenor of the times for change. He states plainly the scope of knowledge about pesticides and the environment today, and strongly emphasizes that much remains to be done.

More of this balance sheet on the environment is annotated in "Terracide," a frightening title behind which much solid excellent information is catalogued. For the description of "chemical bread" alone, this book is well worth reading. Donora, we may all recognize, but Linton has instead chronicled the seldom fatal but just-as-impossible-to-live-with incidents and accidents, such as Selby-

ville, Delaware, and Georgetown in Washington, D.C. In each location, the human nose was tried beyond duration.

The chapter on "Death of a Lake" is a graphic presentation of cultural eutrophication, worth taping as a guide for the visitor to the Staten Island Museum's exhibit on Cultural Eutrophication.

Environment is not a book but a magazine issued ten times a year from St. Louis by the Committee for Environmental Information and is the official publication of the Scientists' Institute for Public Information. Formerly called *Scientist and Citizen*, it is now in its twelfth year of publication.

Environment publishes fully informative articles by specialists on environmental problems. These articles are edited for the layman who is concerned and wants to learn but who may not be able to interpret formulae and mathematical interpretations of phenomena. Over the years the articles published in this journal have become reference sources for the groups interested in informing the public. As further information is made available additional articles on the environment appear in the magazine to provide continual coverage of the problem, including not only scientific knowledge, but where necessary, legal, social, cultural, and other information. This magazine is an important tool for the worker in environmental committees, and for the scientist who is concerned enough to want to lend his talents to help find solutions.

—GAIL SCHNEIDER

PROCEEDINGS

Staten Island Institute of Arts and Sciences



CONTENTS

Articles

BUTTERFLY MIGRATIONS ON STATEN ISLAND	
Arthur M. Shapiro	66
INTERNATIONAL CONFERENCE ON MERCURY CONTAMINATION	
Dorothy Kriete	71
REED'S VALLEY AND REED'S BASKET WILLOW SWAMP	
ON STATEN ISLAND Mathilde P. Weingartner	85

ANNUAL REPORT

THE STATEN ISLAND INSTITUTE OF ARTS AND SCIENCES	
1969-1970 George O. Pratt, Jr., Director	78

INDEX for Volume 25 (complete)	90
--------------------------------	----

<i>Contributors to this Issue</i>	95
-----------------------------------	----

Editor: G. K. Schneider

Butterfly Migrations

on Staten Island

by ARTHUR M. SHAPIRO

Butterflies seem such ethereal creatures that it surprises many people to learn they may migrate thousands of miles. Every year great flocks of them, representing a dozen or more species, move north or south along the Atlantic seaboard. And most of the flocks pass through Staten Island.

There are two broad groups of migratory butterflies: those species which routinely migrate twice each season in opposite directions, like the birds, and those which migrate unidirectionally and not necessarily every year. Strictly speaking, in the eastern United States the first group includes only the famous Monarch, *Danaus plexippus*. The second group includes several species, one of which (the Painted Lady, *Vanessa cardui*) may migrate both ways some years.

If many people know that the Monarch migrates "with the birds," it is largely through the efforts of Dr. Fred Urquhart of the University of Toronto. With the help of a continent-wide corps of cooperating observers, he has followed the movements of the Monarch by a tagging program analogous to bird banding. Each tagged butterfly is given a serial number, printed on the paper tag attached to one forewing. The tag also bears a mailing address. If the insect is captured and mailed in, the serial number allows the Toronto researchers to determine how far it had flown since being tagged. This program, begun nearly thirty years ago, has shown that individual Monarchs from all over the northeast and adjacent Canada fly toward the coast in autumn, forming great flocks on Long Island and Staten Island and continuing to add recruits as they move down the New Jersey shore and thence southward. Eventually they reach Florida and the Gulf states. The migration usually begins in late August in the north, reaching Staten Island late in September; butterflies keep coming through October, and even into early November if the weather is mild. Some years the fall migration is relatively compact, with a definite one- or two-week surge in numbers. Other years it is very protracted, and the numbers on Staten Island remain nearly constant.

In recent years the size of the migration has varied greatly, due to outbreaks of disease which adversely affected the northern Monarch populations.

Why do Monarchs from all over upstate New York, New England, and the Maritime Provinces converge on the south shores of Long Island and Staten Island? For one thing, being flat, the coastal route is easier to fly than one over the hilly interior. For another, the sea may be a significant "landmark" for the butterflies, enabling them to stay on a steady southward course. (We still do not know how most migratory animals, including butterflies, navigate so well.) One other important advantage of a coastal rather than an interior route should be obvious to anyone who has walked the shores at the right season: there is an abundant, dependable supply of nectar, the staple food of the adult Monarch, provided by the plumes of seaside goldenrod. Migrating butterflies literally cover this plant on sunny days. Of course, they have visited other flowers en route—the flat-topped goldenrods, New England and other asters, etc., but these are not so predictably available over long distances. The continuous ribbon of sandy beach offers a sure supply of seaside goldenrod for hundreds of miles. At the end of October, when flowers are few, the late stragglers may even be seen extracting sweets from dandelions.

No Monarchs spend the winter north of the Gulf strip in any stage of their life cycle. In spring Monarchs begin to move north singly, laying eggs as they go and never forming large flocks. These are the children and even the grandchildren of the past fall's migrants, few or none of which live to go north again. The northward movement progresses by stages; the first wave may reach only Virginia or the Carolinas, but its progeny complete the trip to Canada and New England in turn, a month and a half later. The timing of the first arrivals on Staten Island varies a great deal from season to season, from mid-April to early July (most years in the second half of May). In a normal year there will be two or three generations of Monarchs reared here on the host plant, milkweed.

The less regular migrants come *north* in the fall and may or may not be able to reproduce as far north as Staten Island. There is reason to believe Monarch migration evolved not only in response to climate, but to competition with a related southern butterfly, the Queen, as well; but if the reasons are uncertainly known for a much-studied species, they are totally unknown for the others. There is talk of "pressure of population," escaping overcrowding in the south, etc., but it is really unsubstantiated. What we do know is that some of the species which frequently come north in large

flocks are unable either to breed locally or to overwinter, and are completely wiped out at the onset of cold weather. The large Cloudless Sulphur (*Phoebis sennae eubule*), which often arrives in quantity in October, is an example of such a species. Other species may be able to breed here if they arrive early enough, but they cannot overwinter and there is no evidence of a return migration. These include the Buckeye (*Precis lavinia coenia*), the Variegated Fritillary (*Euptoieta claudia*), and the Fiery Skipper (*Hylephila phylaeus*). Two other migrants which definitely breed and may occasionally overwinter are the Little Sulphur (*Eurema lisa*) and the Snout Butterfly (*Libytheana bachmanni*). Both of these are famous mass migrants elsewhere in their ranges. Swarms of Little Sulphurs have invaded Bermuda from the mainland, while flights of literally millions of Snout Butterflies have been reported in the southwestern United States.

Many southern species turn up from time to time as rare strays, often accompanying migratory swarms of the commoner species. These include the Long-tailed Skipper (*Urbanus proteus*), Ocola Skipper (*Panoquina ocola*), Gulf Fritillary (*Agraulis vanillae*), and others.

Perhaps the most unusual of our migrants is the Painted Lady, which combines elements of regularity with great periodicity. It is the most nearly cosmopolitan of all butterflies and in most of its range is considered strongly migratory. In both America and Europe it cannot overwinter in most of its summer range, which it must reinvade by migration every year. In Europe the northern populations are descended from immigrants from North Africa; in this country, from central Mexico. Some years the Painted Lady fails to show up at all in the north, but in other years it may be exceedingly abundant. In such good years (*e.g.* 1968 and 1970), there is often a return flight southward in autumn. Migrations involving many millions of Painted Ladies have been seen in the west; in the east such numbers are rarely if ever noted, but in 1968 the spring migration was unusually early and large, and Painted Ladies bred in upstate New York from April to October. The usual food plant of the Painted Lady is thistle, but when it is abundant it may attack other plants, including borages, mallows, and legumes.

Two relatives of the Painted Lady—the Painted Beauty (*Vanessa virginiensis*) and the Red Admiral (*Vanessa atalanta*)—are also somewhat migratory, the latter also in Europe. Both do, however, survive the winter each year at the latitude of Staten Island. The Red Admiral is especially interesting because it often appears in numbers at lighthouses, suggesting that it, like many birds, migrates mostly at night. All of the Vanessas are active in dim light as

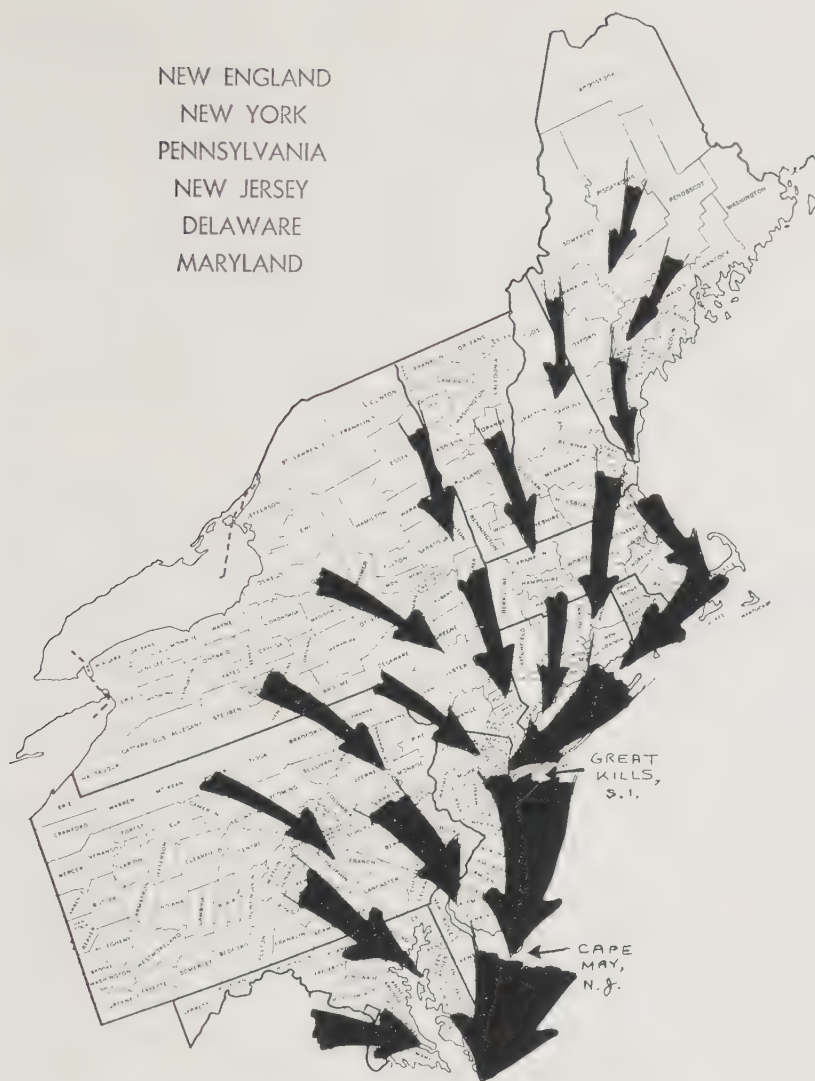


FIGURE 1. Probable migration routes of the Monarch butterfly in the northeast.

well as in strong sunlight, and the Red Admiral seems to mate at sunset.

All of the species mentioned can be seen along the south shore of Staten Island, though not necessarily together in one year. Perhaps the best spot for them is Great Kills Park, between the parking lot and Crooke's Point. In 1970 the migrants seen there included the Monarch, Variegated Fritillary, Buckeye, Red Admiral, Painted Beauty, Painted Lady, Snout Butterfly, and Little Sulphur. The peak of the migration came October 7, when tens of thousands of Monarchs covered the beach after collecting there during a week of balmy weather. With them were about 150 Painted Ladies, also headed south, and a number of Buckeyes, Red Admirals, Painted Beauties, and Little Sulphurs as well as other migratory insects (Milkweed Bugs, the Rattlebox and Corn Ear-

worm Moths, and various dragonflies). The entire flock of Monarchs, along with most of the Painted Ladies, had departed by noon two days later, with a cold front bearing down on them. (A few days later these butterflies probably passed through Cape May, New Jersey, another place where swarms often settle for days.) More individuals continued to arrive on Staten Island after they left, but changeable weather kept them moving and prevented the accumulation of another great swarm at the park.

One Monarch taken October 7 had a tag. Dr. Urquhart confirmed that it had been labeled at Cobourg, Southern Ontario—about 300 miles from Staten Island, much of it over rugged mountainous country.

Standing at Crooke's Point, one can watch Monarchs set off southeastward over the water heading for a Jersey shore they cannot possibly "know" is there. Further along, we know there is Florida sunshine waiting for them, even if they don't. There is a good deal more to these butterflies' lives than a carefree pursuit of flowers, and a good deal more to Nature than we are likely to understand.

Suggestions for Further Reading

- Abbott, C.H. 1951. A quantitative study of the migration of the Painted Lady butterfly, *Vanessa cardui*. *Ecology* 32: 155-171.
- Brower, L.P. 1961. Studies on the migration of the Monarch butterfly. I. Breeding populations of *Danaus plexippus* and *Danaus gilippus berenice* in south central Florida. *Ecology* 42: 76-83.
- Johnson, C.G. 1969. Migration and Dispersal of Insects by Flight. Methuen, London. 763 pp.
- Jones, J.W. 1943. Autumnal Migration of *Phoebis sennae eubule*. *Entomological News* 54: 133-134.
- Urquhart, F.A. 1960. The Monarch Butterfly. University of Toronto Press. 361 pp.
- Williams, C.B. 1930. The Migration of Butterflies. Oliver and Boyd, Edinburgh. 473 pp.

International Conference on Mercury Contamination

by DOROTHY KRIETE

Scientists are finding increasing evidence of the deleterious effects on the environment of minute quantities of heavy metals. The dangers of lead poisoning are well known. Recently Japanese doctors discovered that a painful disease called "Itai, Itai," or "Ouch, Ouch," which weakens the bones, is caused by cadmium intoxication. Since the Institute always has been concerned with the education of the public against the dangers arising from pollution in the environment, it is contemplating an exhibit for the Staten Island Museum on the debasing effects of mercury in the biosphere. The writer attended the International Conference on Mercury Contamination to learn more about this type of pollution.

Ten percent of all inland waters in the United States are contaminated with mercury. This could have been prevented had we known of the research being conducted 15 years ago in Sweden and Japan. This was the sense of an address by Senator Warren G. Magnuson of Washington, chairman of the Senate Commerce Committee, in which he advocated the establishment of a World Environmental Institute.

International cooperation was the mood as scientists from six countries, representing educational and governmental research centers, as well as industry and labor, assembled in Ann Arbor from September 30 through October 2, 1970, to explore the state of research and the extent of the problem, common to each of their nations. "Mercury contamination is not a global problem in the way that DDT is; it is a local problem," Dr. Arne Jernelov, head of biological research at Sweden's Water and Air Pollution Laboratory, declared in an interview for the *Ann Arbor News*. Unlike DDT, which has been carried by winds all the way to Antarctica, mercury vapors apparently settle near their sources. (In seeming contradiction to Dr. Jernelov's statement, Sweden's Environment Protection Board has reported since the Ann Arbor conference that possible sources of mercury, the factories, are hundreds of miles from the contaminated lakes.) Sweden is the

country which is most advanced in the study of mercury pollution, but even there no solution has been found as to the source of mercury which still plagues her waterways even after the industrial emissions have been outlawed.

The International Conference on Mercury Contamination was sponsored by the University of Michigan's Institute of Environmental and Industrial Health, its Institutes of Environmental Quality and of Science and Technology, Michigan State University's Office of Research and Development and its Institute of Water Research, and the International Association of Water Pollution Research. Participants were invited to present material to delineate further the sources, distribution, and effects of environmental mercury contamination. The United States has only recently become cognizant of the dangers deriving from mercury pollution. This conference was an attempt to pool international knowledge by calling together scientists, especially those who have been studying the effects of this metal's compounds on the biota for as long as 15 years. In addition to Dr. Jernelov with Sweden's research report, Dr. Takeuchi of Japan offered vivid descriptions of the Minamata Bay disaster. These, together with American accounts of the recent Alamogordo tragedy, spurred the scientists' desires to learn to control this danger.

Concern was appropriately centered in Michigan where, because of the ban on sport fishing in Lake St. Clair and its connecting waterways, the local citizenry suddenly had become aware of mercury as doing more than quietly creeping up and down the thermometer. Calling it a "displaced element," the director of the Institute of Environmental and Industrial Health welcomed the assembly with an emphasis on the all-pervasiveness of such elements in our environment. About 5,000 tons of mercury enter the earth's biosphere annually through natural processes and a like amount is dumped through industrial effluents or carelessness. Michigan scholars provided statistics to suggest that air may contain .04 ppm of mercury. Water not known to be polluted is thought to be about .06 ppb mercury, but may range up to 1.0 to 2.8 ppb.

In the United States last year, over six million pounds of mercury were consumed. Much of this is believed to have re-entered the environment, directly through natural processes or indirectly through the combustion of fossil fuels, papers, batteries, fluorescent bulbs, or coated seeds. Of the more than six million pounds, 1.6 million were utilized by power plants, 1.3 million by the chlor-alkali industry, and sizeable amounts by agriculture for seed coating and fungicides, and by manufacturers in paint, dental and pharmaceutical, electrical, and amalgam industries.

Research done since February by the Michigan Water Resources

Commission indicated some sources of mercury in the Great Lakes. Wyandotte Chemical, a chlor-alkali plant, had been dumping ten to 20 pounds per day into the Detroit River. A General Electric plant used mercury in magnets for electronic components and some of the 1500 pounds used annually found its way into the water. Investigation of a mysterious fish kill in the Iron River in Michigan's Upper Peninsula revealed that a laundry had been using phenylmercuric acetate, a mildew deterrent, in its operation, allowing its effluent to enter directly into the river. Waste treatment plants, which each utilize 50 to 60 pounds of mercury in flow meters and assorted equipment, were another identifiable source of contamination. In the air, .5 ppm of mercury may have been released by Detroit Edison and Consumers' Power's burning of soft coal from southeast Ohio. A Federal Water Quality Administration scientist had measured up to 21 ppm of mercury vapor in the air over Santa Barbara, where refining is done. This has an implication for Staten Island because of its proximity to the New Jersey refineries.

The distribution of mercury in the environment of the Great Lakes was discovered by analyzing fish from various parts of the Lakes. It was clearly indicated that fish caught nearest the industrial centers on the Lakes contained the highest mercury percentages in their systems. Great Lakes walleyes, yellow bass, and yellow perch were used as index species for analysis. Mercury accumulates in fish so that larger fish, which are at the top of the food chain, have a much higher percentage of mercury per pound of body weight. These are the fish most likely to be sought for human consumption. Northern pike from contaminated waters contained .7 ppm of mercury, muskellunge weighing 1.5 pounds contained 1.2 ppm, and 16-pound muskellunge recorded up to 6.7 ppm. Body tissues, eggs, livers, and intestinal tracts of water birds were also tested. Livers of great blue herons from contaminated areas contained 125 ppm; livers of the common tern showed 25 to 30 ppm. These amounts compare with amounts discovered in dead birds analyzed in Sweden in the middle 1960's. Finnish scientists have determined that it takes 400 days to purge mercury from the viscera of a fish.

To clean a lake such as St. Clair, even after all sources of contamination are identified and corrected, would require removing the diseased species and probably dredging the bottom of the lake.

The U.S. Department of Health (Food and Drug Administration), has adopted 0.5 ppm as the maximum level of mercury acceptable in fish for human consumption. This admittedly arbitrary level was based on the smallest amount of mercury detectable

some years ago. The Ontario Department of Health has accepted the same threshold. Representatives to the conference from each department presented findings of research on the distribution of mercury among inhabitants of the Great Lakes region. Hair sampling by the neutron activation process was termed the most satisfactory method of testing for mercury in humans. The levels of mercury in hair seem to correlate directly with the amount of fish eaten by people in contaminated areas and levels from 150 to 200 ppm have been found. This is excessively high, for Japanese doctors have found 1.0 ppm in persons showing symptoms of mercury poisoning. At the present time no indications of pathologic effects have been noted in persons in the United States or Canada from eating fish. "Fish for Fun" signs have been posted near waters with mercury levels higher than 0.5 ppm.

Seven papers were presented describing methods for testing for mercury which included gravimetry, polarography, radiochemistry (exchange of isotopes), titration, photometric mass spectrography, and neutron activation. Among these methods were a direct combustion process through which mercury becomes a vapor which can be sensed and a non-destructive technique in which the sample remains reusable. A representative from the Olin Corporation presented his company's process, which it is prepared to sell to other companies, which is claimed to detect as little as 0.5 ppb both in water and in gas.

Thus far in this report a grave error has been committed by referring simply to "mercury." Conferees were repeatedly cautioned against this, for, in speaking of this element in the environment, care must be taken to identify the species, e.g., elemental mercury or organic mercury such as ethyl-, phenyl-, or methylmercury. Each has special properties which cause it to bind differently to various substances and various tissues. The inter-conversions of mercury in the environment was the subject of Dr. Jernelov's first lecture. He has become the authority on methylmercury, the form most dangerous to fish and mammals since its rate of retention in tissues is the highest. Birds seem to have the ability to methylate mercury in their systems. Fish ingest mercury in the form of methylmercury from the food chain. Methylmercury is formed in the water through the action of microorganisms on di-valent or inorganic mercury, sometimes mercuric sulfide, in the bottom sediment. A lower pH value of the water increases the activity of the microorganisms as does an aerobic condition. At a higher pH, more of the methylated mercury becomes di-methylmercury, a more volatile compound. The Scandinavian scientist suggested four possible means of detoxifying contaminated waters, but seemingly dismissed each of them, leaving

the dilemma unsolved. They were: (1) covering the mercury-rich sediment with inert clay, (2) dredging, which would be expensive and leave the problem of disposing of the dredged material to be solved, (3) adding hydrogen sulfide or ferrous sulfide, or (4) liming, or otherwise raising the pH value of the water, so that the volatile compound di-methylmercury would be formed. This, however, might spread the pollution over a larger area.

After discussions of the interconversions of mercury in the food chains a temporary panel was formed to evaluate for the conference the research needs in environmental mercury problems. Agreement was registered that there exists a primary need for more predictability. Where does the mercury enter the environment? How does it travel? (How does it get to the Green Mountains of Vermont where there are no industrial plants?) More needs to be known of its physical-chemical properties in water, about the solubility of di-methyl-, mono-alkyl-, and mono-methylmercuries. The work of Dr. Jernelov's group is important but we still do not know enough about the rate of methylation in the environment. Little has been done to learn about the element's rate of absorption by different animals. The rates of adsorption and desorption out of muds have not yet been explored. Research needs to be done on the breakdown in humans of methylmercury into inorganic forms which can be excreted. What factors reduce methylation? Dr. Leonard Goldwater of Duke University Medical Center, who has been a long-time student of mercury intoxication since his work with employees of the felt hat industry, asked for more controlled research to be accomplished before scientists accept commonly held ideas as canon law.

The balance of the conference gave purpose to all of the foregoing research discussion. It was concerned with dose-response relationships in mammals after known exposure to organic mercury environmental loadings. Dr. Goldwater strongly recommended consulting the industrial hygiene literature for available information on this issue. From the December 1969 *Archives of Environmental Health*, data was extracted which caused the American Industrial Hygiene Association to lower the permissible exposures in the occupational environment to one-half its former level. Research sponsored by the Chlorine Institute at Wayne State University had involved 20 plants where 642 employees were found to be exposed to a trace of mercuric oxide in cell rooms in which they worked. Symptoms of loss of appetite, weight loss, insomnia, shyness, nervousness, diarrhea, alcohol consumption, and dizziness were reported in varying degrees by these workers. From this low exposure to mercury vapor, signs of tremors, and frequent colds also could be observed.

The most severe epidemic of mercury poisoning, recorded in recent years, occurred at Minamata Bay in Japan. Dr. Tadao Takeuchi from the Kumamoto University School of Medicine described the outbreak of what is known now as Minamata Disease which killed or severely disabled 121 persons.

In Minamata, a vinylchloride and acetaldehyde plant discharged large quantities of methylmercury through waste water. From 1950 until 1958 the effluent was channeled into the Minamata Bay, but then was diverted into the Minamata River. It was not until 1960 that equipment for waste water treatment was installed.

The customary dietary practices of the inhabitants included very frequent, if not daily, consumption of fish and the entire fish, including the liver as well as the muscle, was eaten. In 1956 an epidemic erupted, affecting the nervous systems of the victims. Of the 121 cases, 68 adults were affected, 30 children, and 23 fetal cases. Out of these there were 46 deaths. Dr. Takeuchi showed many slides and films of persons and animals suffering from the disease and of organs wasted by the attacks. These pictures dispelled any notions that mercury contamination was a theoretical problem resulting in the death of a few fish or birds, and gave the conference a sense of urgency.

The three main nervous symptoms described by Dr. Takeuchi were cerebellar ataxia, constriction of visual fields, and dysarthria. The onset of the illness was acute or subacute and usually unattended by fever. Numbness developed in the extremities and frequently around the mouth.

The episode of mercury intoxication in the United States presented for the conference participants was the tragic history of the Huckelby family of Alamogordo, New Mexico, reported by Dr. Alan Hinman of the New York State Department of Health. In 1969, several poor farmers received free waste mercury-treated seed from a granary. One of them, Mr. Huckelby, mixed this seed with garbage and cooked it to comply with New Mexico law before feeding it to his 19 hogs and one boar. In December he sacrificed the boar for his own table and the family ate the meat. Over the course of three weeks, 12 feeder pigs died and after some weeks his eight-year-old daughter developed an ataxic gait and became comatose. One week later the ten-year-old developed the same pattern and after ten days the 20-year-old daughter became ill. Initially the patients were diagnosed as encephalitic, but after investigation and the autopsy of the dead pigs, mercury intoxication was identified. The two older children recovered but at the time of the conference the youngest girl still lay in a coma. The mother had been pregnant and gave birth to a child in March. The infant had initial convulsions, but now seems normal. It is too

soon to assess brain damage in the poisoned members of the family.

The conference ended on a note of discouragement for many of the participants. No reliable means of diagnosing low-level cases of mercury poisoning are known as yet. No method of dealing with mercury already in the environment seems to be effective. No scientist from any of the various industries or agencies represented offered any plans for decreasing the amounts of toxic mercuries which their processes deposit in the environment. The only real conclusion reached was the need for more and continued cooperation and research.

Suggested Reading for Mercury Contamination Article

- Larsson, J.E. "Environmental Mercury Research in Sweden," Swedish Environment Protection Board. CI Pamphlet No. MIR-103, New York, Chlorine Institute, Inc., 1970.
- Löfroth, Göran. "Methylmercury," Sweden, Natural Science Research Council. New York, Chlorine Institute, Inc. CI Pamphlet No. R-101, 1969.
- Minamata Disease*. Study Group of Minamata Disease, Japan, Kumamoto University, 1968.
- Parker, Carl E. "Mercury—Major New Environmental Problem," *The Conservationist*, v.25, no. 1 (Aug.-Sept. 1970) pp. 6-9.

ANNUAL REPORT

of the Staten Island Institute of Arts and Sciences,

1969-1970

by GEORGE O. PRATT, JR.

Five years ago the Institute undertook the responsibility for the creation and administration of High Rock Park Conservation Center, at New Dorp, Staten Island. The 68-acre area, formerly the High Rock Girl Scout Camp, was mapped as City Parkland in May 1965. With small grants from the American Conservation Association and with the cooperation of the Community Council of Greater New York we established a limited program of guided tours. From the very outset we endeavored to preserve the natural beauty of the area and, except for the creation of new trails and the renovation of structures, this goal has been met essentially and the Park remains in much the same condition five years later.

Between the years of 1966 and 1968, the program was greatly expanded by funds received under Title III of the Elementary and Secondary Education Act (E.S.E.A.). In 1968 and 1969 the program was continued through joint funding by the Parks, Recreation, and Cultural Affairs Administration and a grant from the Ford Foundation. In 1969 the program was sustained at the same level through funds provided by the Parks, Recreation, and Cultural Affairs Administration. In 1970, this form of intermittent funding was superseded by permanent allocation of funds from the City, \$113,400, to assure the continuation of the program without the annual fiscal crises which characterized June in 1968 and 1969. The staff has been augmented by the assignment of two teaching positions by the Board of Education and by five Attendants from Parks, Recreation, and Cultural Affairs Administration.

In 1969, program goals of the Park were aided by the formation of a new group known as the Friends of High Rock, made up of more than 450 citizens who have contributed financially to the program.

The City has also allocated substantial capital funds for essential improvements to the Park for reconstruction of water mains and improvement of road areas in the Park. Most important, the City has provided for a new, attractive parking lot located at the Sum-

mit Avenue entrance. This parking lot was admirably designed by Bradford Greene, Vice President of the Institute, to fit the contours and elevation of the area, and it provides space for sixty cars and seven buses.

Our next object will be to obtain funds to construct a simple reception and orientation center, and shift the public entrance to the Park from the present location at Nevada Ave. to Summit Ave. An additional enhancement to the Park has been authorized by the City Administration which has agreed to acquire a four-acre area, known as the Enfield Tract, to provide High Rock with protection for Walker Pond plus an open field habitat for lessons in field ecology.

A plan for the more diverse and expanded use of the William T. Davis Wildlife Refuge was outlined in the September 1969 *Proceedings* (Volume 24: Number 2). The plan calls for the broadening of the administration and staff of the Refuge not only to allow continuation and increase of guided tours for schools, but also to utilize the entire Refuge as an ecological laboratory for research teams concerned with environmental investigation.

The over-all program has been favorably received by the Parks, Recreation, and Cultural Affairs Administration (P.R.C.A.A.). The Institute has requested an allocation of approximately \$40,000 for the Refuge to be used immediately for designs and plans for the conversion of two existing structures into a water quality testing laboratory and an orientation building. When these projects are realized, the Refuge will be able to be used all year around by classes throughout New York City.

Sessions were held with officials of P.R.C.A.A. on the advisability of closing Travis Avenue and forestalling any further development of Park Drive North.

In the meantime, the Refuge continues to be fully booked in the spring and fall with great pressure being exerted by teachers throughout the City schools for increased opportunities for visiting. It is regrettable that we have been unable to achieve greater progress in the design plans mentioned earlier.

During the year a new exhibit, designed by the artist Joseph A. Smith, on "Cultural Eutrophication," was installed on the main floor of the Staten Island Museum. The exhibit represented a breakthrough in exhibition concepts through its use of new and modern materials. It is part of the continual effort by the Institute to introduce greater emphasis on environmental issues, using modern exhibition methods, on the main floor of the Museum.

Progress was achieved this past year in one direction for the benefit of the museum building when design plans for the renovation of the electrical systems of the building were completed

and accepted. Work on this is expected to start some time during the first six months of 1971. Regretfully there has been no progress in achieving the urgently needed repairs to the roof and a replacement of the aged heating system.

The problem of long-needed new facilities was approached in two ways: (1) Through allocation by P.R.C.A.A. of \$15,000 to the firm of Clark and Rapuano to project the long-range needs of the Institute, particularly in view of the relatively new responsibilities arising out of the administration of High Rock Park. After nearly an 18-month delay in processing this contract agreement, the report is now approximately 75% complete and will be finished early in 1971. It will outline a program for long-range growth in both the arts and the sciences. (2) A more immediate thrust towards enlarged facilities has occurred through the negotiations and deliberations over the possible relocation of the Museum in the complex of Greek Revival buildings at Sailors' Snug Harbor. Five of these buildings have been designated as landmarks by the Landmark Preservation Commission and the Commission, the P.R.C.A.A., and other City agencies have worked closely with the Institute staff in projecting plans for the renovation of these buildings for museum purposes and our eventual occupancy. A decision on the question is expected within the next six months.

The scope and intensity of the work falling on the staff of the Institute, as a result of the combined efforts to bring about both increases in program and the physical facilities of the Institute in all of its activities, required the addition of two new employees on the private payroll, one to assist in the Library and the other to provide expanded secretarial services for the Director. This decision, which required deficit financing by the Institute, was taken only after prolonged discussions by the trustees. However, the increase in staff was an inevitable concomitant with the growth of the Institute's budget and non-administrative personnel. The size of this growth can be illustrated by noting that in 1965 the staff numbered 14 full-time employees and has grown to approximately 45 full-time employees in 1970. The actual number of persons actively involved in Institute work is greater still because of the participation over the past four years of Urban Corps interns and Neighborhood Youth Corps workers, an average of 14 part-time workers yearly.

Primarily as a result of the growth of the program at High Rock Park, the attendance in all activities sponsored by the Institute has grown to 150,000. 1970 was a period of rewarding affirmation and confirmation of the emphasis given over the past decade by the Institute to the seriousness of the environmental problems which face the entire nation as well as our local community.

The Institute, through High Rock Park and the Staten Island Museum, participated extensively in "Earth Day" activities in April 1970. Just as important, the Institute continues its active support of organizations and individuals on Staten Island concerned with environmental issues. It has been gratifying to know the astonishing growth, concern, and awareness on the part of Staten Island residents over their need to participate actively on the conservation issues facing us. Issues which were barely noted a few years ago: preservation of open space, greenbelt, protection of natural contours, care of the remaining marsh areas, the distress over the destruction of large areas of the western shore of the Island by sanitary land-fill, the concern over air and water pollution, have now become recognized throughout the Island. Equally, Islanders have learned to ask hard questions about the highways and their effects on Staten Island. Many have come to question that further growth in population means progress rather than chaos.

We are restrained from extensive solicitation for gifts to our collections because of lack of space in which to house them. This is related to our inability to increase further the programs offered to the public and to the members of the Museum because of the constraint imposed upon us by the small auditorium and by the lack of work and studio space. This has been the theme of annual reports for the past ten years or so and it is still true.

The Department of Art received several outstanding acquisitions of works of art during 1969 and 1970:

Blue and white porcelain paste box, Chinese, Ch'ing Dynasty (1644-1912) bearing the mark of the K'ang Hsi period (1662-1722). This was in a bequest from Mrs. Minnie Smith which also included a collection of modern oriental ivory carvings and \$2,000. (A69-10.1-.)

"Black and White" by Eleanor Mikus, American contemporary. Acrylic composition on wooden panels. (A69-11.1)

"Untitled" sculpture by Barrie Cameron McDowell, American contemporary. Bronze. (A69-11.2) Both the gift of The Pace Gallery, New York City.

Six examples of antique Chinese jade carving for the William Wood Memorial Collection. Anonymous gift. (A69-12.1-6)

"Seascape with Waves Breaking on the Rocks" by Paul Dougherty (1877-1947). Oil sketch on wood. Gift of Mrs. Frederick A. Dewey. (A70-1)

Received for the Study Collection of Prints and Drawings:

"Figure of a Man" by Helen Seasonwein, American contemporary. Pencil drawing on white paper. Gift of the artist. (A70-13)

Donors to the costume and textile collections included Mrs. James H. Barrett, Mrs. I. J. Belmont, Mr. and Mrs. Jonas M. Goldstone, Mrs. James S. Hedges, and Mrs. Ben Ali McAfee. The following pieces are of special interest:

Five examples of Romanian folk art, all hand-woven and embroidered. Late 19th century. Gift of Mrs. Belmont. (A70-4.1-5)

Four oriental costumes, including a splendid brick-red silk damask kimono, tie-eyed and embroidered, Japanese, 19th century. Gift of Mr. and Mrs. Goldstone. (A70-5.1-4)

During the year there were three exhibitions of works selected from the Museum's collections, in addition to the Annual Section of Art Spring Show and two special exhibitions: "Cecil C. Bell: New York Paintings of 30 Years"; "Coalition '70." Catalogues were published for the last two shows.

The South Gallery remained closed for most of the fall months while the storeroom and office were being remodeled. The Downstairs Gallery, to be devoted most of the time to Island artists, opened in October 1969 with its first exhibition.

Annual Report of the Treasurer

1969/70

Receipts and expenditures of the Institute in the fiscal year ended June 30, 1970 are shown in the following summary:

RECEIPTS:

Interest and dividends	\$21,370.65
Dues from individual members	6,145.00
Other dues (organizations, etc.)	215.00
Museum and High Rock Shops profit	7,862.50
Contributions and miscellaneous	4,574.75
TOTAL RECEIPTS	\$40,167.90

EXPENDITURES:

Salaries and supplements to City-paid salaries	\$13,550.32
Other Museum operating expenses	12,659.05
Publications	3,245.57
Davis Memorial Lectures	1,165.00
Miscellaneous	1,495.45
TOTAL EXPENDITURES	\$32,115.39

Additional gifts aggregating \$46,715.57 were received for specific purposes, and other funds were collected for special activities. These amounts and the expenditures therefrom are excluded from the above summary, as are gifts of objects for exhibit or other purposes. The Institute also received \$130,000 from the Department of Parks for the administration and maintenance of High Rock Park Conservation Center.

Principal Funds increased \$66,232.39 during the year from profit on sales and exchanges of securities and sale of property.

At June 30, 1970 the private funds of the Institute were represented by the following:

Securities held by the Institute:		
U.S. Treasury Obligations		\$13,000.00
Other		167,485.42
Securities held by First National City Bank		273,940.64
Securities held by Dean Witter Co.		42,340.24
Cash held by Dean Witter Co.		(223.37)
Cash held by Institute:		
Checking Account	\$32,227.96	
Savings Accounts	25,446.21	
Petty Cash	300.00	57,974.17
Cash held by First National City Bank		685.72
Museum and High Rock Shops inventory		3,751.52
Nominal value of equity in Museum Building		
Exhibitions and Fixtures		1,000.00
Less Payroll Tax Withholdings		1,133.17
	TOTAL	\$558,821.17

The City supplemented the above figures with an appropriation under the 1969-1970 annual budget of \$105,500. This was used for salaries and maintenance of the Museum in the following ways: Executive Management \$39,600; Curatorial \$15,760; Building Maintenance and Protection \$40,940; Office Supplies, Repairs, Utilities, etc. \$9,200.

Victor J. Morone

STATEN ISLAND INSTITUTE OF ARTS AND SCIENCES 1969-1970

OFFICERS

President Emeritus, Manuel J. Johnson
President, Terence H. Benbow
First Vice-President, Thomas Schleier
Second Vice-President, Bradford M. Greene
Treasurer, Victor J. Morone
Secretary, Eldridge Peterson

BOARD OF TRUSTEES

A. M. Anderson	Robert L. Jacobson, D.D.S.
Mrs. Charles E. Beyer	Dr. J. Trygve Jensen
Ira Blei, Ph.D.	Herbert C. Johnson
Daniel L. Bridgman	Herbert S. King, M.D.
Richard Buegler	Mrs. J. Joyce Klinger
Joseph F. Burke	Sasha Koulisch, Ph.D.
Louis Cenci	Robert M. Leng
Sister Mary Virginia Cotter, Ph.D.	John H. Lotz
(resigned May 1970)	George H. Maginley
Charles J. D'Arrigo	Louis R. Miller
Dean James L. G. FitzPatrick	Mrs. Horace P. Moulton
Robert P. Hagenhofer	Dr. Peter K. Nelson
Joseph J. Holzka	Mrs. Adolph Ostwald

Hon. Royal S. Radin
John S. Robotham
Richard M. Silberstein, M.D.
(resigned October 1970)
David C. Smith

C. L. Stong
Wesley E. Truesdell
Manning W. Voorhees
Joseph A. Weissglass

EX-OFFICIO MEMBERS

Hon. John V. Lindsay
Hon. Robert T. Connor
Hon. August Heckscher
Dr. Mary E. Meade
Professor Arleigh B. Williamson
Maurice P. Wollin

DIRECTOR

George O. Pratt, Jr.

STAFF

Staten Island Museum: Elsie P. Verkuil, Assistant to the Director; Jacqueline C. Louie, Membership Secretary; Elizabeth M. Marziale, Bookkeeper; Margaret Nichols (from April 1970), Secretary; Eileen Pizzuto, Telephone Operator; Receptionists (Weekends): Mary Morone (from June 1970), Roberta Butler, Shawn Benbow (from June 1970). Mathilde P. Weingartner, Curator of Science; Barry Leo Delaney, Curator of Art; Freda Esterly, Curator of Education; Gertrude Ferry, Educational Assistant; Gail K. Schneider, Editor/Librarian; Dorothy Kriete, Assistant Librarian (from June 1970). Theresa Cenci, Manager of museum shop; Shop Assistants: Geraldine Cenci, Ingrid Kjeldaas (from June 1970), Betsy Greene (from June 1970). Carmine J. Taverna, Museum Maintainer; Carl C. Scacco, Senior Museum Attendant; Museum Attendants: John Fillinger, Eddy Kamil (from September 1969), Anthony Levato (from October 1969), Charles R. Logan (from October 1969), Herbert Means, Tim O. Martin (to July 1969), Joseph A. Palladino (to October 1969).

High Rock Park Conservation Center: Harry F. Betros, Director of Education; Cynthia Jacobson, Field Coordinator; Ethel Z. Dicke, Program Coordinator; "Friends of High Rock": Allison Mitchell, Elizabeth Seder; Helen Hauber, Senior Clerk; Charlotte B. Clegg, Clerk. Instructors: Rudolph Lindenfeld, Olivia Hansen, Marie C. Burke, Gunda Halloran, Dorothy Aruny, Lucille Geary, Lenore Miller, Joan Kosan, Robert Zappalorti. Guides: Philip Benjaminson, Marion Briggan, Harold Brundage, Anne Marie Doolos, Ruth Corbett, Nina Clegg, Dorothy Fleming, Erna Gundlach, Louise Halama, Edward Hansen, Beulah Hauber, Evelyn Hare, George Johnston, Gordon Johnston, Faith Mounier, Rose Munkasey, Arthur Peters, Mary Piraino, Dorothy Quinlan, Susan Quinlan, Clayton Woolney, Letitia Zappalorti. Shop: Jean Raymond, Manager; Nina Clegg and Susan Quinlan, Weekend Attendants. Dominic Botta, Assistant Museum Maintainer; Michael Betros, Anthony Asaro, Kenneth Lewis, Charles Taverna, Museum Attendants.

William T. Davis Wildlife Refuge: Mathilde P. Weingartner, Curator.

Urban Corps Student Interns: Alexa Perry, John Unnana, Marilyn Atkins, J. Richard Clarke, Stephen Goldston, Charles Cunningham, Patricia Piracci, Stuart Ashman, James Elliott.

Volunteer: Alfons Schoenemann.

Reed's Valley and Reed's Basket Willow Swamp on Staten Island

by MATHILDE P. WEINGARTNER

This area, located on the southeastern slope of Todt Hill and below Ocean Terrace, is threaded with a number of brooks separated by ridges. All of these brooks terminate in the stream that flows alongside the Perine House on Richmond Road. (Please see accompanying map.)

Two swampy areas have been formed in low spots in the valley because of natural damming. The upper swamp (named Reed's Basket Willow Swamp) was once a pond.

The Reed family raised purple willow trees along the shores of these swamps. These trees supplied the raw material for baskets which were the cottage industry through which the family supported itself. The enterprise itself is no longer in operation, but a small vegetable and flower garden still surrounds the house standing there.

The ridges between the brooks support a woodland of oak, beech, and hickory trees, with many other trees, shrubs, and flowers growing in the understory. (A list of these follows this article.)

During the 1950's the Brooklyn Union Gas Company ran a pipe across this area. The machinery used to dig the trench for this pipe was of such dimensions that a space fifty feet in width was cleared of vegetation all the way down the hill. Nothing was planted in the wide scar but apparently the soil was tamped down sufficiently so that erosion was held more or less in check. A gully up to about 18 inches deep in spots has been checked periodically with stone dikes.

The vegetation that has come in since this pipeline was laid is made up principally of grasses and European weeds, such as are listed as adventives in the list below. The pipeline was held



mostly to the ridges so that less damage resulted from this operation than from the following:

About four years ago a construction firm hired a bulldozer to clear a swath, again about fifty feet wide, straight down one of the stream beds and then alongside of the upper swamp. (At that time this swamp was still a pond.) Much of the soil was pushed down into the pond and erosion accounted for more soil filling it in, so that today most of the pond is reduced to about ten percent of its original size and is very shallow. What was once a pond is now a growth of arrow arum in a muddy bottom. The drought of this past summer may have been of some influence here.

As a further result, the land has eroded from the top of the hill (a drop of about one hundred feet in a distance of probably five hundred feet). This erosion has caused some very deep gullies, since the bulldozer did not tamp down the soil. Outside of the gully, the whole area is covered with a very dense stand of blackberry bushes, and here again, some of the adventive trees and shrubs can be found. Of special note here is the Japanese knotweed (*Polygonum cuspidatum*); it does not seed itself, and therefore the roots of a plant must have been dislocated by the bulldozer from the top of the hill. This plant is mixing with blackberry and since both grow rapidly, we can expect that they will cover the scar, except for the gully which will continue to erode.

The woodlands below the upper swamp are in relatively good

shape and are little disturbed so far by the rapidly encroaching population. Swamp white azalea and pinxter bushes form an understory for the oak woodland as do blueberry bushes, sweet pepper-bush, and flowering dogwood. Indian pipes grew profusely here last summer and the beech trees, with a few exceptions, still have their bark intact.

Because of the protected location, the profusion and diversity of plant species, the many berries that grow here, and the availability of water, this area is a natural haven for wildlife. Since it is near the Olmsted Trailway it might be included in this project to protect it in its present form. It would be a shame to see it used as a location for a shopping center or a high-rise apartment house.

Open space requirements on Staten Island are increasing as population grows. Existing open areas are beginning to show hard wear. While these should continue to be maintained and managed, the acquisition of more open space, particularly of such varied habitat, would be well advised to fill future open space needs.

Plants Found in the Area of Reed's Basket Willow Swamp

TREES

Red Oak *Quercus borealis*
 Black Oak *Q. velutina*
 White Oak *Q. alba*
 Gray Birch *Betula populifolia*
 Black Birch *B. lenta*
 Beech *Fagus grandifolia*
 Ironwood *Ostrya virginiana*
 Pignut Hickory *Carya glabra*
 Mockernut Hickory *C. tomentosa*
 Red Maple *Acer rubrum*
 Tulip Tree *Liriodendron tulipifera*
 Sassafras *Sassafras albidum*
 Hackberry *Celtis occidentalis*
 White Ash *Fraxinus americana*
 Pin Oak *Quercus palustris*
 Carolina Poplar *Populus deltoides*
 Large-toothed Aspen *P. grandidentata*
 American Chestnut *Castanea dentata*
 [stump sprout]
 Black Willow *Salix nigra*
 Purple Willow *S. purpurea*
 Black Locust *Robinia pseudoacacia*
 Sweet Gum *Liquidambar styraciflua*
 Sour Gum *Nyssa sylvatica*
 Black Cherry *Prunus serotina*

Flowering Dogwood *Cornus florida*

Adventives:

Ailanthus *Ailanthus altissima*
 Hercules Club *Aralia spinosa*

SHRUBS

High-bush Blueberry *Vaccinium* sp.
 Huckleberry *Gaylussacia* sp.
 Swamp White Azalea *Rhododendron viscosum*
 Pinxter Azalea *R. nudiflorum*
 Red-osier Dogwood *Cornus stolonifera*
 Arrow-wood *Viburnum dentatum*
 Maple-leaf Viburnum *V. acerifolium*
 Hazelnut *Corylus americana*
 Elderberry *Sambucus canadensis*
 Sweet Pepper-bush *Clethra alnifolia*
 Chokeberry *Aronia* sp.
 Black Haw *Viburnum prunifolium*
 Bayberry *Myrica pensylvanica*
 Spicebush *Lindera benzoin*
 Crab-apple *Malus* sp.
 Smooth Sumac *Rhus glabra*
 Dwarf Sumac *R. copallina*
 Blackberry *Rubus allegheniensis*

VINES

- Grape *Vitis* sp.
 Japanese Honeysuckle *Lonicera Japonica*
 Virginia Creeper *Parthenocissus quinquefolia*
 Cathbriar *Similax rotundifolia*

FERNS

- Christmas Fern *Polystichum acrostichoides*
 Royal Fern *Osmunda regalis*
 Cinnamon Fern *O. cinnamomea*
 Sensitive Fern *Onoclea sensibilis*
 New York Fern *Thelypteris noveboracensis*
 Marsh Fern *T. palustris*
 Hay-scented Fern *Dennstaedtia punctiloba*
 Lady Fern *Athyrium filix-femina*
 Interrupted Fern *Osmunda claytoniana*
 Spinulose Wood Fern *Dryopteris austriaca* var. *spinulosa*
 Intermediate Wood Fern *D. austriaca* var. *intermedia*
Azolla caroliniana was at one time introduced into the upper pond. It has not been noted lately, however.

MOSSES AND LIVERWORTS

- Catherinea Moss *Atrichum* sp.
 Sphagnum Moss *Sphagnum* sp.
 Riccia *Riccia fluitans*

HERBACEOUS PLANTS

- Canada Mayflower *Maianthemum canadense*
 Solomon's Seal *Polygonatum* sp.
 Skunk Cabbage *Symplocarpus foetidus*
 Arrow Arum *Peltandra virginica*
 Yellow Star-grass *Hypoxis* sp.
 Indian Pipe *Monotropa uniflora*
 Wild Rose *Rosa* sp.
 Common Blue Violet *Viola* sp.
 Jewel-weed *Impatiens biflora*
 Whorled Loosestrife *Lysimachia quadrifolia*
 Wild Indigo *Baptisia tinctoria*
 Water-horehound *Lycopus* sp.
 Pokeweed *Phytolacca americana*
 Wild Sarsaparilla *Aralia nudicaulis*
 Spring Cress *Cardamine bulbosa*

- Common Cinquefoil *Potentilla* sp.
 Deadly Nightshade *Solanum nigrum*
 Arrow-leaved Tearthumb *Polygonum sagittatum*
 Lady's Thumb *P. persicaria*
 Common St. John's-wort *Hypericum perforatum*
 Sheep-laurel *Kalmia angustifolia*
 Horse-balm *Collinsonia canadensis*
 Meadow-beauty *Rhexia* sp.
 Forget-me-not *Myosotis* sp.
 Beech-drops *Epifagus virginiana*
 Indian Hemp *Apocynum cannabinum*
 Pipsissewa *Chimaphila umbellata*
 Evening-primrose *Oenothera* sp.
 Hog-peanut *Amphicarpa bracteata*
 Blue-stemmed Goldenrod *Solidago caesia*
 Canada Goldenrod
 Rough-stemmed Goldenrod
 Woodland Aster
 Heath Aster
Aster patens
 Joe-Pye Weed *Eupatorium* sp.
 Boneset *Eupatorium perfoliatum*
 Blue Lettuce *Lactuca pulchella*
Andropogon virginicus
Andropogon scoparius
 Reed *Phragmites communis*
 Fox-tail Grass *Setaria* sp.
 Blue-stemmed Grass
Panicum clandestinum
 Duckweed *Lemna* sp.
 Dodder *Cuscuta* sp.
 Large Ragweed *Ambrosia trifida*
 Small Ragweed *A. artemisiifolia*
 Wormwood *Artemisia* sp.
 Beggar's Ticks *Bidens* sp.
 False Nettle *Boehmeria cylindrica*
 Poison-ivy *Rhus radicans*
 Lamb's-quarters *Chenopodium album*
 Curled Dock *Rumex crispus*
 Cat-tails *Typha* sp.
 Adventives:
 Peppergrass *Lepidium* sp.
 Burdock *Arctium* sp.
 Yarrow *Achillea* sp.
 Thistle *Cirsium* sp.
 Red Clover *Trifolium pratense*
 Asiatic Day-flower *Commelina communis*
 Queen Anne's Lace *Daucus carota*

Japanese Smartweed *Polygonum*
caespitosum
Colt's Foot *Tussilago farfara*
Japanese Knotweed *Polygonum*
cuspidatum

FUNGI

Russula emetica
Amanita phalloides

GEOLOGY

Serpentine
Quartzite
Limonite
Limonite concretions (Puddingstone)

ANIMALS

Rabbits
Squirrels
Green Frogs
Garter Snake

BIRDS

[summer list]
Spotted Sandpiper
Sharp-shinned Hawk

Crested Flycatcher
Flicker
Chickadee
Robin
Woodthrush
Catbird
Brown Thrasher
Baltimore Oriole
Yellowthroat
Myrtle Warbler
Cardinal
Indigo Bunting
Towhee
Songsparrow
Goldfinch
Blue Jay
[winter list]
Junco
Cardinal
Brown Creeper
Blue Jay
Mourning Dove
Downy Woodpecker
Crow
White-throated Sparrow
Song Sparrow

INDEX for Volume 25: Numbers 1-3 (complete). 1970
(Italicized page numbers indicate illustration.)

A

Abbott, Mabel 58
 Alamogordo, N.M. 72, 76
 albino cowbird 41
Altenaria 34, 35, 37, 39
 American Academy of Allergy, Pollen
 Survey Committee 34, 39
 Animals, list of (Reed's Valley) 89
Ann Arbor News 71
 Annual Report 1969-1970, S.I.I.A.S.,
 by George O. Pratt, Jr. 78-84. Amer-
 ican Conservation Association 78;
 Art, Department of 81; assistant li-
 brarian 80; attendance at Institute
 activities, (annual) 80; Belmont,
 Mrs. I. J. 81; capital funds allotted
 by N.Y.C. 78; Community Council
 of Greater N.Y. 78; "Cultural Eutro-
 phication" exhibit 80; Dewey, Mrs.
 Frederick A. 81; "Downstairs Gal-
 lery" 81; "Earth Day" 80; electrical
 systems, renovation of 80; "Enfield
 Tract" 78; environmental issues 80;
 exhibitions of art 81; Goldstone, Mr.
 and Mrs. Jonas M. 81; High Rock
 Park Conservation Center 78-79, 84;
 Landmarks Preservation Commission
 (N.Y.C.) 80; new accessions (Dept.
 of Art) 81; new employees 80; Of-
 ficers and Board of Trustees 83;
 Pace Gallery (donor) 81; Parks,
 Recreation, and Cultural Affairs Ad-
 ministration (PRCAA) 78; *Proceed-
 ings* 79; Sailor's Snug Harbor (pos-
 sible new home for Institute) 80;
 Seasonwein, Helen 81; secretary to
 the Director 80; Smith, Joseph A.
 80; Smith, Mrs. Minnie 81; Staff
 Members: Museum 83, High Rock
 84, Davis Refuge 84; Staten Island
 Museum 80; Treasurer's Report
 (1969-1970) 82; Urban Corps 80,
 84; volunteers 84; Walker Pond 78;
 William T. Davis Wildlife Refuge
 79, 84; William Wood Memorial
 Collection 81.

Apollo spacecraft 18

archaeological dig 45

ARTICLES: "The Moon, Our Nearest
 Neighbor in Space" Behm 5-30;

"Ragweed Pollen Count for S.I.
 1969" Kosan 34-39; "Bird Counts
 on S.I. 1969-1970" Weingartner 40-
 43; "College Students and The In-
 stitute" 44-52; "Natural History
 Records 1954-1960" Weingartner
 53-56; "Butterfly Migrations on S.I."
 Shapiro 66-70; "International Con-
 ference on Mercury Contamination"
 Kriete 71-77; "Reed's Valley and
 Reed's Basket Willow Swamp on
 S.I." Weingartner 85-89

AUTHORS: Ayers, Clyde 44-48;
 Behm, Hans 5, 30; Beil, Carlton 57;
 Kosan, Joan 34-39; Kriete, Dorothy
 59-61, 71-77, 95; Odenthal, John
 45; Pratt, George O., Jr., 78-84, 95;
 Schneider, Gail 44-52, 61-62; Sha-
 piro, Arthur 66-70, 95; Weingartner,
 M.P. 40-52, 53-56, 85-89, 95.

Ayers, Clyde 44-48

B

Baldwin, R. B. 6, 8, 10, 13, 28
 Barabashov, N. P. 12, 28
 Basket Willow Swamp, Reed's 85
 Behm, Hans J. 5-30, 30; 19, 28
 Beil, Carlton, reviewer 57-59
*Best Nature Writing of Joseph Wood
 Krutch*, reviewed by Dorothy Kriete
 59-61

BIBLIOGRAPHY & REFERENCE:

Butterflies, migratory 70; mercury
 contamination 77; Moon 28-29; pol-
 len 39

Billops Funeral Home 46

"Bird Counts on S.I. 1969-1970" by
 M. P. Weingartner 40-43

birds, list of (Reed's Valley) 89

Board of Higher Education (N.Y.C.)
 44

BOOK REVIEWS 57-63

Bowker, Dr. Albert, Chancellor 44

Boyle, Robert H. 61-62

Brooklyn Union Gas Company 85

Buckeye, *Precis lavinia coenia* 68

"Butterfly Migrations on S.I." by
 Arthur Shapiro 66-70

C

Cameron, A. W. 13, 28

- Cape May, New Jersey 70
 Carson, Rachel 62
 Chambers Funeral Home 46
 chlor-alkali industry 72
 Christmas bird count, annual 40-42
 church records, S.I. 47
 Citizens Against Bus Exhaust
 (C.A.B.E.) 51
 City College of N.Y. (C.C.N.Y.) 45
 City Planning Commission, N.Y.C. 51
 City University (C.U.N.Y.) 44-52
 Cloudless Sulphur, *Phoebis sennae euhule* 68
 "College Students and the Institute"
 44-52
 Columbia University 45
 Committee for Environmental Information 63
 comparison, ragweed seasons, 1968,
 1969 35, 38
 Copernicus 6
 Costello, Dr. Timothy, Deputy Mayor
 44
 Crooke's Point 69
 "Cultural Eutrophication" (exhibit)
 63
- D
 DDT 71
 detoxification of mercury contaminated
 waters, methods of 74
 di-methylmercury 74
 Duke University Medical Center 75
 Durham Pollen sampler 34
- E
 "Earth Day" 51
 ecological action 48-52
 Eggleston, J. M. 23, 29
 Ellison, Lee A. 53
Environment 62, 63
 environment, mercury problems in the
 74-75
- F
 Federal Bureau of Public Roads 59
 ferns, listing of (Reed's Valley) 88
 Fiery Skipper, *Hylephila phylaeus* 68
 Firsoff, V. A. 13, 16, 28
 fungi, listing of (Reed's Valley) 89
- G
 Galileo Galilei 5
 Gault, D. E. 19, 28
 geology, Reed's Valley 89
- Gilvarry, J. J. 14, 28
 Glossary, "The Moon" 30
 Gold, T. 11-12, 28
 Goldwater, Dr. Leonard 75
 Graham, Frank, Jr. 61-62
 Great Kills, Park, S.I. 69
 Green, J. 7, 9, 13, 28
 Gulf Fritillary, *Agraulis vanillae* 68
- H
Helminthosporium 34, 37, 39; 35
 Hinman, Dr. Alan 76
 "History of the Black Man on S.I."
 45-48
Hormodendrum 34, 35, 37, 39
 Huckelby family 76
Hudson River, The, by Robert H.
 Boyle (review) 61-62
 human ecology 62
- I
 ILLUSTRATIONS: Plate section,
 "The Moon," follows page 16.
 Information booth, ecology action, S.I.
 Ferry Terminal 50, 51
 "International Conference on Mercury
 Contamination," by Dorothy Kriete
 71-77
 "Itai, Itai" 71
- J
 Japanese knotweed, *Polygonum cuspidatum* 87
 Jernelov, Dr. Arne 71, 72, 74, 75
 Jet Propulsion Laboratory 11
 Johns, Frank J. 49
- K
 Kapp, R. O. 11, 28
 Kosan, Joan 34-39
 Krejci-Graf, K. 14, 28
 Kriete, Dorothy 59-61, 71-77; 95
 Krutch, Joseph Wood 59-61
 Kuiper, G. P. 11, 17, 18, 28
 Kumamoto University School of Medicine 75
- L
 Lake St. Clair 72, 73
 Lamb, J. 28
 Landers, Shelley 49, 52
 Linton, Ron M. 62-63
 Little Sulphur, *Eurema lisa* 68-69

liverworts, list of (Reed's Valley) 88
 Long Tailed Skipper, *Urbanus proteus* 68
Lost Heritage, by Henry Savage, Jr. 61-62
 Lowman, P. D., Jr. 13, 28
 Luna 9 17, 26

Mc

McAllister, Maureen 49
 McGovern, Marianne 45
 McGrath, Deborah 45

M

Magnuson, Senator Warren G. 71
 Markov, A. V. 12, 28
 Martin, Jean 45
 Martin, Lindsay 49
 Mathewson, Robert A. 53
 mercury and the food chain 73
 — contamination (article on) 71-77
 — in birds 73
 — in fish 73
 —: maximum level acceptable in fish for human consumption (as of 1970) 73
 — poisoning, nervous symptoms 76
 — species 74
 — testing in humans 73
 —, used in agriculture and industry 72-73
 — vapor, measurement of, over refineries 73
 meteorological conditions, effect of on daily pollen count 35, 36
 methylmercury 74
 Michigan, University of 72
 Michigan Water Resources Commission 72
 migrations of butterflies, suggested reasons for the 67
 migratory butterflies, two groupings of 66
 Minamata Bay Disaster 72, 75-76
 Mitchell, John G. 58
 mold spores, part of pollen count for 1969 34-39
 Monarch, *Danaus plexippus* 66-70
 "Moon, The" by Hans J. Behm, 1-30; plate section follows page 16. (Pt. I):
 aa lava flow (def.) 30; ancient astronomical concepts 6; bulk density,

upper moon layers 11; caldera (def.) 30; Cavalerius 17; chain craters 6, 8; chemical composition, lunar surface, Surveyor V site 23; Cobra Head 23; comparison of lunar craters to earth calderas 9-10; craters, lunar, recorded (20th C.) 6; CRATERS: Alphonsus 11, 13, 18, 26; Archimedes 13; Aristarchus 24; Bonpland 13; Cavalerius C & F 14; Clavius 6; Copernicus 16, 20; Flamsteed, ghost crater 11, 20, 14a; Fra Mauro 13; Galilaei 14; Gambart 11; pl. 8, 16; Grimaldi, walled plain 15; Guericke 13; Hevelius pl. 10; Hyginus pl. 12; Jansen 13; Jansen R 13; Lambert R 13; MacLear 13; Maskelyne F 13; Parry 13; Plato 13; Ptolemaeus 13; Riccioli pl. 27; Tycho 23, pl. 6; Wallace 13;
 crustal upheaval, lack of evidence 8; dust (lunar) hypothesis 12; early concepts in lunar studies 5; Eastern Sea SEE Mare Orientale; grabens, comparison with lunar fractures 14; impact craters or volcanoes 7, 9; Inghirami pl. 26; Lansberg, 13; lopolitic (def.) 30; lunar craters, origin of (see also CRATERS) 5; lunar domes 15; lunar fracture structures 14-15; lunar mountains 9; lunar seas SEE maria; lunar surface, early speculations 6; lunar (def.) 30; maar craters (def.) 10; maria, composition of 11; MARIA: Mare Cognitum 9; Mare Crisium; Mare Humorum 14, 16; Mare Imbrium 13, 15, 25, pl. 13; Mare Orientale pl. 28; Mare Tranquillitatis 13, 16; Mare Veris pl. 28;
 Marius Hills 16, 27, pl. 15; mascons 25, 27; micrometeoroids, impacting bodies 12, 13; MOUNTAINS: Harbinger pl. 11; Rook pl. 28;
 nuée ardente (var. volcanism) 24; Ocean of Storms SEE Oceanus Procellarum; Oceanus Procellarum 13, 14, 16, pl. 4, pl. 10, pl. 17; physical data, Moon (fig. 1) 7; RILLES: 14; Ariadaeus 15; Campanus 1, 17; Hyginus pl. 12; Hyppalus 14, 17; Rima Prinz I & II pl. 11;
 sky observations, early history 5; spectral analysis, significance of discovery 5; Spring Sea SEE Mare Veris; telescope, invention of 5; VALLEYS:

Alpine (Moon) 15, 24, 27, pl.13;
Schroeters 24;
vesicular structures 21, 26; volcanic
craters 9; volcanism, 8; wrinkle
ridges 14 16, 17.
mosses, listing (Reed's Valley) 88
Mowbray, A. Q., author of *Road to
Ruin* 57

N

Natural History Records, 1954-1960.
Assembled by M. P. Weingartner
53-56
Natural Science Association of S.I. 53
Neighborhood Youth Corps 45-48
New York University 45

O

Ocola Skipper, *Panoquina ocola* 68
Odenthal, John 48-52
Oepik, E. J. 13, 28
Ogden, E. C. 35, 39
O'Keefe, J. A. 13, 28
Olin Corporation, mercury detecting
process 74
Olmsted Trailway 87
Ontario Department of Health 73
open space requirements (current)
on S.I. 87
oral history, interviews for 46, 47
Orbiter Missions 15, 16, 17, 22-23,
24, 25, 26, 27
Orbiter I 11;—V 23

P

Painted Beauty, *Vanessa virginiensis*
68
Painted Lady, *Vanessa cardui* 66
Perine House 85
plants, listing (Reed's Valley) 87-88
Pratt, George O., Jr. 78-84

Q

Quaide, W. L. 19, 28

R

Ragweed pollen count, S.I., 1969, by
Joan Kosan 34-39
Ranger Missions 5, 17, 18, 26
Rangers: VII 11, 12, 18;—IX 18,
26;—XIV 15
Raynor, G. S. 35, 39

Reading Lists: butterflies 70; mercury
contamination 77
"recycling" 49, 51
Red Admiral, *Vanessa atalanta* 68
"Reed's Valley and Reed's Basket Wil-
low Swamp on S.I." by M. P. Wein-
gartner 85-89
References: Moon 28-29; pollen 39
Richmond College 51, 52
Richmond College Library 46
Richmond County Clerk's Office 46
Road to Ruin by A. Q. Mowbray, re-
viewed by Carlton Beil 57-59
Rostoker, D. 12, 28

S

St. George Regional Library Center
46
Sandy Ground Cemetery 46
Savage, Henry, Jr. 61-62
Schmidt, R. A. 19, 28
Schneider, Gail 44-52, 61-63
Schomberg Collection 46
Scientist and Citizen 63
Scientists' Institute for Public In-
formation 63
Section of Natural History (S.I.M.)
53-56
sediments, bottom, mercury in 74
Shapiro, Arthur 66-70; 95
shrubs, listing (Reed's Valley) 87
Simon, Carmen 45
Since Silent Spring by Frank Graham,
Jr. 61-62
Snout Butterfly, *Libytheana bach-
manni* 68, 69
Spurr, J. E. 6, 8, 13, 15, 16, 28
Staten Island Advance, The 49
S. I. Community College 52
S. I. Ecology Action Center 45, 48-52
S. I. Greenbelt Natural Area League
(S.I.G.N.A.L.) 58
S. I. Historical Society 46, 47
S. I. Institute of Arts & Sciences SEE
Annual Report; History Library 46
S. I. Museum 63; SEE also Annual
Report
Storm King Mountain 62
Students for the Conservation of
American Resources (S.C.A.R.) 48
Surveyor Missions 17, 18, 20-22, 25,
26;—I 16, 21; V 22, 23

Sweden's environmental programs on
mercury 71
symptoms, mercury poisoning 75
Sytinskaya, N. N. 11, 28

T

tagging program, butterflies 66, 70
Takeuchi, Dr. Tadao 72, 75, 76
Terracide by Ron M. Linton 62-63
Trapp, Paul I. 45
trees, listing (Reed's Valley) 87

U

U. S. Department of Health (F.D.A.)
73
University of Toronto, Canada 66
Urban Corps, City of N.Y. 44-52;
SEE also Annual Report
Urquhart, Dr. Fred 66, 70

V

Van Willis, Sharon 45
Variegated Fritillary, *Euptoieta*
claudia 68
Vincent, Pamela 45
vines, listing (Reed's Valley) 88

W

Water and Air Pollution Lab., Sweden
71
waterbird count 42-43
Weingartner, Mathilde P. 40-43, 53-
56, 85-89; 95
Westfall, J. E. 19, 28
wildlife, natural haven for 87

Z

Zumberge, T., quotation from (1963)
2

ABOUT OUR CONTRIBUTORS

Arthur M. Shapiro is an Assistant Professor of Biology at Richmond College, specializing in insect ecology. He received his B.S. from the University of Pennsylvania and his Ph.D. from Cornell University, where he worked on food-plant selection by butterflies. He has been a research assistant to the Philadelphia Academy of Natural Sciences and the Laboratory of Genetics, Oxford University, and is a frequent contributor to entomological journals.

Dorothy S. Kriete is assistant librarian at the Staten Island Institute of Arts and Sciences. She received her B.A. from Heidelberg College, Tiffin, Ohio, and her M.L.S. from Spalding College, Louisville, Kentucky. She worked previously at the Cardinal Spellman Library, Notre Dame College, on Staten Island; in the town library, Gelnhausen, Germany, and in the U.S. Special Services Library, Worms, Germany.

Mathilde P. Weingartner is Curator of Science for the Staten Island Museum as well as Curator of the William T. Davis Wildlife Refuge. She has been the author of many articles printed in previous *Proceedings* and in other scientific publications. She is the author of *The Staten Island Walk Book*.

PROCEEDINGS

Staten Island Institute of Arts and Sciences



CONTENTS

Articles

PHILIP OCTAVIUS GRAVELLE: An Early 20th Century Photomicrographer	F. Gordon Foster	3
THE PHILIP OCTAVIUS GRAVELLE PHOTOMICROGRAPH COLLECTION		14
URBAN ECOLOGY IN SEARCH OF ITSELF		15
Arthur M. Shapiro		
WHY COUNT BIRDS?	M.P.W.	20
CHRISTMAS BIRD COUNT	1970	22
Mathilde P. Weingartner		
NATURAL HISTORY RECORDS	1961-1969	24
Prepared by Mathilde P. Weingartner		
<i>About Our Contributors</i>		27
<i>Books Received</i>		28

Editor: G. K. Schneider

Published May 1971, in its ninetieth year, by The Staten Island Institute of Arts and Sciences, 75 Stuyvesant Place, Staten Island, New York 10301.



PHILIP OCTAVIUS GRAVELLE

An Early 20th Century Photomicrographer

by F. GORDON FOSTER

Whether the compound microscope was truly an invention or a natural part of scientific evolution is a moot question. Contemporary writers, to satisfy readers of history, often give credit to Hans and Zacharius Janssen, Dutch opticians, as inventors of the compound microscope around the end of the 16th or the beginning of the 17th century.

Just when photomicrography had its exact beginning is even more indefinite. For years, scientifically-minded people, both amateur and professional, had been experimenting with light-sensitive compounds.

Early microscopists had to be satisfied with projection drawing or tracing of images they observed through their microscopes. This was time-consuming and often reflected more of the microscopist's artistic ability than true findings. It was natural then that photomicrography would follow. Here again, just when the first photomicrograph was taken on the early wetplate cannot be stated with accuracy. It is known, however, that the art was well developed before the American Centennial Exposition of 1876. Brigadier General John J. Woodward exhibited a group of interesting photomicrographs of diatoms, insect parts, and medical subjects at the exposition. Many of these pictures are still in a remarkable state of preservation.

Philip Octavius Gravelle had no part as an originator of the microscope, photography, or photomicrography. Gravelle, however, did much to bring photomicrography to its present day high quality and importance, and recognized the great potentialities of this growing field.

Gravelle was born in San Francisco, California, in 1877 and was brought east by his mother at a very young age. He was educated in local elementary schools and Jesuit schools of eastern Canada. A long and happy married life, started in June 1900, lasted until late 1952 when his beloved wife, Clara, passed away.

Chemistry, a favorite subject, was studied evenings at Pratt Institute in Brooklyn, New York. As a profession, Gravelle combined his artistic ability with that of textile design. This work included not only the design but following the pattern through the chemical processing at the mill.

It was by a fortuitous circumstance that Gravelle was brought into microscopy and later photomicrography. A microscope entrusted to him for safekeeping by a vacationing friend whetted his appetite for seeing a new and undiscovered world. His desire to see this new world, a microcosmos, was paramount and, whether the subject was animate or inanimate, it was quickly prepared for the stage of the borrowed microscope.

Shortly after their marriage the Gravelles moved to a small cottage in South Orange, New Jersey. Enthusiasm in the use of the microscope and photomicrography and the addition of equipment came so rapidly that space in the cottage was soon at a premium. Photomicrography had its start in a little room playing a double role as bath and laundry. Before long a sitting room was appropriated, and later the walls of the little dining room doubled as library space. Clara often jokingly declared, "If I can't have more space, we will have to move."

The answer to the space problem was solved in 1934 when ground was broken for a spacious laboratory at the rear of the house, its size making "the tail wag the dog." Nevertheless the originally appropriated areas of the cottage were never relinquished.

Modern electricity for home use had not yet reached South Orange. Illuminating gas, with the now little known or forgotten "Welsbach mantle," supplied the high intensity light he required. Early attempts at photomicrography used specimens that Gravelle brought into his laboratory from his garden pool. Simultaneously, he started buying prepared slides from the finest slide makers of the world, such as Thum, Dalton, Poyser, Mollier, Watson, and Booth, a practice he continued to the end of his career.

The first interest in slides for photomicrography was in those of the diatomaceae, microscopic organisms of pure silica, with tiny perfect and uniform geometrical patterns. In an effort to reach a theoretical resolution of 120,000 lines to the inch with the compound microscope, the diatoms became ideal specimens for experimental study, using various illuminating sources, filters, and photographic materials. While at this time these specimens were a chal-



PHILIP OCTAVIUS GRAVELLE

lence to the optical or light microscopist, it is interesting to note that the same specimens are still of interest to those now using the modern "electron" and "scanning" microscopes.

Gravelle was an early riser, and during this period of experimentation he was also commuting to New York City for his textile work. Microscopy as a hobby was growing and while his interest in fresh water and marine life never diminished during his career, an increasing number of commercial subjects came to his laboratory. Manufacturers brought problems to him as word about his work spread around, for at this time there were no commercial, industrial, or crime laboratories of this type in existence.

The first client, a manufacturer of wall plaster, presented a processing problem. This manufacturer's plaster was not setting as fast as his competitor's. As a manufacturer he was losing trade;

how could the microscope help him regain his prestige? By spreading the powdered plaster of both client and competitor on small glass plates to make dispersion slides, Gravelle found that the competitor's plaster was of a finer sieve size. Excessive milling of the client's material would reduce his profits. It was for Gravelle to determine the cut-off point, the point of faster plaster setting vs. economic milling.

Another contract which soon followed was from a leading fountain-pen maker. Smoothness of writing was a function of preparation of the pen nib. Low power photomicrography, now known as photomacrography, was used not only to show the smoothness of the nib but also the centrality of the slit which acted as a canal between the ink reservoir and paper.

During the intervening years much progress had been made with the application of the microscope in medical work. In many cases Gravelle cooperated with the medical profession in the solution of their problems. He was interested in the study of human skin, particularly in the influence on it of various cosmetics. At one time he moved much of his equipment to a nearby hospital where he set up a special laboratory to study the results of various oils applied to the bodies of new-born babies.

Industrial and forensic microscopy were slower in getting started. Gravelle had already made some strides in these fields, and more and more clients were seeking his help. Surely the old adage, "If a man build a better mousetrap the world will find him," was now more than just a saying. Probably his interest in forensic microscopy was sharpened by a book, "The Microscopist's Companion," written in 1858, which described two instances where the microscope had played an important part in the solution of crime. In one case a man, by false accusation and feeble evidence, had been condemned to the gallows. The second case was about to release a murderer before the microscope found him guilty. Oddly, the outcome of both of these trials depended on the microscopy of human and animal hair.

Bullets are "fingerprinted" by the rifling of the barrel from which they are fired. Before long, Gravelle was made a lieutenant in the New York City Police Department, bringing both guns and fired slugs to his laboratory for comparison. For this new field he designed a comparison eyepiece, a device that could straddle two microscopes and split the individual fields. By rotating the slugs, the "lands and valleys" could be critically matched where the same gun had been used. Photomacrographs showing the centration of firing-pin marks on used shells and chamber markings were also made as a means to further justice.

Photomicrography as a more accurate means of advertising was

3751



Leather-leaf Ash. 1943. (Negative No. 3751)

a brain-child of Gravelle. Bed sheets of competing manufacturers were washed, dried, and ironed under ordinary conditions. After each cycle, a predetermined area went to his laboratory for photography under the microscope. Time after time, the sheets passed through successive tests, until the last sheet was washed beyond further household use. Photomicrography showed the textile manufacturers what was happening all along the way. An era was approaching in which big advertising words would need to be exchanged for facts.

How "runs" start in ladies' hosiery, breakage seams occur in men's shirts, why residual coarse splinters appear in toilet tissue, what were the particle sizes of scouring powders, whether there were starch adulterants in face powders—these were but a few of the many problems that would be solved in the coming years.

Gravelle's laboratory was a virtual showroom for variety of equipment and neatness of arrangement. Here microscopes, illuminating systems both incandescent and arc, centrifuges, balances, microtomes, counting devices, and optical accessories seemed without limit. Adjoining his main laboratory was his photographic dark-room, ventilated and light tight, filled with trays and tanks, automatic temperature controls and a tray-rocking machine which he designed. Shelves were stocked with all kinds of films, plates, and printing papers. In all, nothing was overlooked that would hinder this man from turning out the finest photomicrographic record of his investigations.

Most of his negatives were not the result of the first exposure. With Gravelle it was try, try again until perfect sharpness and contrast were reached, whether it required eight, ten, or twelve trials. I recall my first lesson with Phil when he told me, "Buy yourself a good waste basket and learn to use it." In his notebook he meticulously recorded each negative, giving optical combinations of lenses, amount of exposure, developing formula with concentration, temperature, and time.

Gravelle was a scholar of light and chemistry, an attribute which remained so helpful throughout his career. The early twenties had little to offer in comparison with today's photographic emulsions. Various early color methods, now obsolete and unknown, Dufay, Paget, and Autochrome, lacked much in color quality. Kodak had not yet introduced its new color films. Gravelle hit upon an idea, a process long lost in expired patents—that of dye-coupling. His plan was to make black and white prints into monocolored prints which would be available to commercial photographers and illustrators. Using his knowledge of organic chemistry, he experimented with hundreds of solutions and was able to produce just about any color shade he desired. His process was not meant to produce



Tabular Quartz. 1943. (Negative No. 3760-2)

permanent prints with relatively unstable compounds employed, but rather to have a print last long enough for a photoengraver to take over. Before long, photography studios were licensed to use the new Gravelle Creatacolor Process. The process was short-lived, however, as modern and lasting color emulsions came on the market.

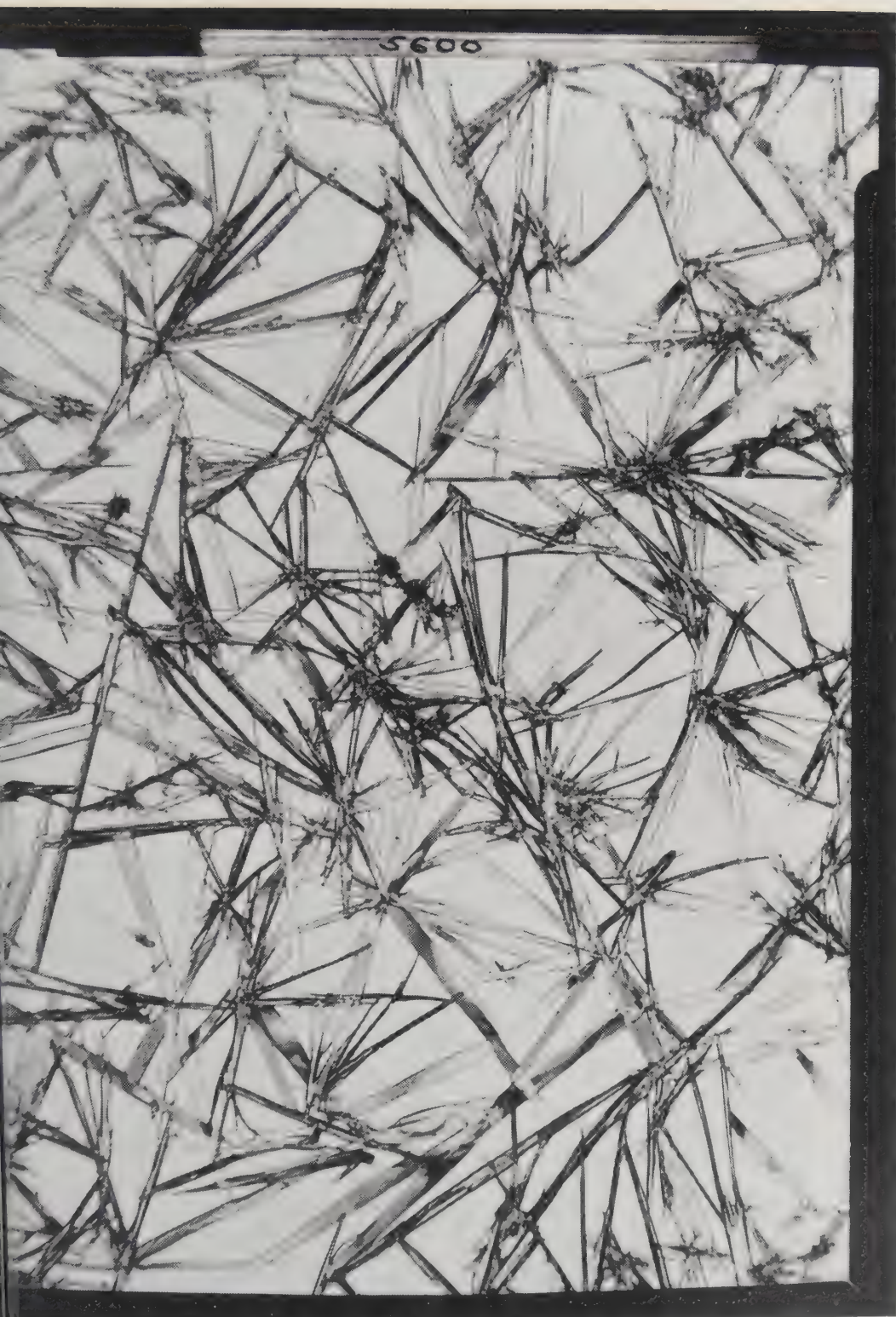
Resolution, the ability to see structure through the compound microscope as discrete dots or lines, is a function of the light-gathering power of the objective lens and the wavelength of light illuminating the specimen. This statement, really an interpretation of the mathematical equation,

$$\text{Resolving power} = \frac{\text{Lambda}}{\text{N.A.}}$$

where Lambda equals the wavelength of light and N.A. equals the numerical aperture or light-gathering power of the objective, had been expostulated by the German scientist, Dr. Ernest Abbe, in the late 19th century.

While such an equation was based on theoretical concept, Gravelle and his contemporaries were determined to reach the ultimate in practice. After business, long hours were spent in the laboratory trying to gain a resolution of more and more lines to the inch. High intensity arcs, deep blue filters to allow only the shorter wavelengths of light to pass, the finest oil immersion apochromatic objectives of the period, and high contrast photographic plates were used in the hope of reaching new levels in vision. Diamond-ruled gratings and diatoms with closer and closer structures were sought as temporary goals were reached.

Gravelle frequently devised accessories to help him in his work—things ranging from simple homemade gadgets to professionally made optical instruments. One item in particular was his microscope illuminator, later built and marketed by the world-renowned Eimer and Amend Company. His plan was to project onto the specimen the image of the filament of an incandescent lamp, thus flooding the object with intense, uniform light. The scheme would be particularly appropriate for examining specimens at relatively low magnification, such as 10- to 30-fold enlargement. Unfortunately, the filaments of conventional incandescent lamps are made in the form of a closely wound helical-coil of thin tungsten wire. The projected image of such filaments appears as a zigzag pattern of light and shade; is not uniformly bright. Gravelle suggested the substitution of a filament in the form of a flat plate of tungsten foil about three-eighths of an inch square. A filament of this type would cast a uniformly bright image. The lamp was designed and manufactured for Gravelle by engineers of the General Electric Company,



Oxalic Acid. (Negative No. 5600)

at its Nela Park Works in Cleveland, Ohio. The enclosing glass bulb measured three inches in diameter and eight inches in height. The tungsten plate was heated by 50 amperes of electric current at a potential of 5.6 volts supplied by a transformer that could be adjusted to vary the voltage as desired. Although the lamp consumed only 280 watts, the relatively large current requirement posed a difficult engineering problem. Ordinary lamps of comparable power would require less than three amperes. The heavy current caused the terminal circuits of the lamp to overheat, despite the use of an air blower for cooling the apparatus. The engineers equipped the lamp with an over-size screw base of the "mogul" type. It did not work. Finally, they solved the problem by equipping the bulb with terminal posts in the form of pure copper rods. The perfected bulb was operated in a rectangular lamp house of sheet metal that Gravelle constructed. He equipped the lamp house with a large lens to concentrate the light and with an iris to control the amount of light that fell on the subject. The unit was supported by a heavy adjustable screw centered on a cast iron crowfoot.

Vacations for Gravelle were really a busman's holiday. For years his vacation periods were alternated between Woods Hole, Massachusetts, and the rock-bound coast of Maine.

At Woods Hole he used the available research facilities of the government biological station and spent many days in coastal trawlers dredging for off-shore organisms. The tidal flats off the coast of Maine provided many pools teeming with marine life. Washed-up seaweeds, particularly when acid-boiled to release countless interesting diatoms, provided hours of searching. Photography was not so simple then; this was years before the 35-millimeter camera with its spool-like fine-grained films and pocket-sized developing tanks. Rather, Gravelle used an 8-by-10 inch plate camera and heavy tripod, carting it from his boarding house to location in a wheelbarrow.

The work of Gravelle was well known throughout this country and abroad. He had great interest in the many scientific institutions of the metropolitan area and willingly contributed both his time and talent. The Staten Island Museum, the American Museum of Natural History, and the New York Botanical Garden were the recipients of some of his outstanding photomicrographic work.

For many years Mr. Gravelle had hoped to publish a book depicting design and symmetry as found in nature through the microscope. Of the negatives given to the Institute's Library he had selected the finest of which he had made 8x10 inch prints to accompany caption sheets which were in the hands of a publisher at the time of his death. The book was not published.

He held memberships in many scientific societies and was honored



P-Hydroxy and Chlorinated Napthalene. (Negative No. 6479)

with fellowships from the Royal Photographic Society, the Royal Microscopical Society, and the New York Microscopical Society. In 1923 the London Microscopical Society awarded him with the Barnet medal, the highest honor gained through an international competition in photomicrography.

Until a few weeks before his death on February 5, 1955, Gravelle entered his laboratory at 6:00 a.m. for a two-hour work period before breakfast. After breakfast a full day of work followed in the laboratory. His evenings were generally spent in his library.

As a man he was quiet, unassuming, and kind. He was always willing to help someone, the prerequisite being that the person had at least tried to help himself. His was a great and full life devoted to the improvement of photomicrography. Standing beside his hospital bed during his closing hours I heard him say with a note of sadness, "I have now taken my last photomicrograph."

THE PHILIP OCTAVIUS GRAVELLE PHOTOMICROGRAPH COLLECTION held by the Staten Island Museum

The lifetime collection of photomicrographs taken by Mr. Gravelle was shared in part by the American Museum of Natural History, the New York Botanical Garden, and the Staten Island Museum.

That collection which was deposited in 1970 with this institution numbers 2,018 film-and or-glass negatives, ranging in time from 1916 to 1954.

Mr. Gravelle grouped his negatives to supply subjects illustrating specific themes. The Staten Island Museum's collection has representative negatives from "Molecular Design: Crystal Growth," "In the Realm of Weird Crystals," "Crystal Growth and Dissolution—Time Lapse," and "Symmetry in Nature."

Photographs made from negatives in this collection illustrate the foregoing article by Mr. Foster who was instrumental in arranging this gift to the Institute.

Urban Ecology

in Search of Itself

by ARTHUR M. SHAPIRO

I

To one who has been long in city pent,
'Tis very sweet to look into the fair
And open face of Heaven.

—Keats, *Sonnets*

The romantic poets did not like cities. They sought refuge from them in an idealized, pastoral nature; until recently ecologists did, too. During the decades when ecology was purely a descriptive science, there was a pervasive preoccupation with the undisturbed: to understand nature one had to exclude the meddlesome influence of man. When succession theory came into its own, the influence of man on natural communities was grudgingly acknowledged—in the hope of observing the restorative processes that would purge the landscape of his traces. This outlook persists in the popular glorification of “Virgin Forest,” ecology’s answer to Wordsworth’s Forest Primeval. “Virgin Forest” is what many city dwellers are apt to call their favorite woodlot. Paradoxically, most people are disappointed when they are shown a *real* virgin forest—precisely because it looks too much like a woodlot.

Romanticism sparked a naturalistic reaction; novelists and poets began to portray life as it was (or worse). Now ecological romanticism has spawned its reaction, and the city is coming under scrutiny. Urban ecology is a popular subject nowadays, if an elusive one. Like the city itself, urban ecology began growing from several different foci and in several different directions. Some of its patterns have merged; others have not. Traditionally, this is the way Western science has grown. At intervals, conceptual thinkers synthesize data from various studies—and a body of disparate facts becomes something more respectable, a science. Urban ecology, of course, is

not a science apart from ecology proper. But ecology itself is a young (and hence relatively disorganized) science. When a symposium on "Urban Ecology Today" was held jointly by the Ecological Society of America and the American Association for the Advancement of Science in Chicago on December 30, 1970, the titles presented ranged from "Ecological concepts in Ontario subdivision design" to "The ecology of feral dogs in Baltimore." All of them were ecological, and all involved cities in one way or another; but there the resemblance ends.

II

Basic researchers view man-modified communities as part of a broader scheme, subject to the same natural laws and participating in the same processes as "natural" communities (old fields, ponds, forests). Man's activities, after all, are only some of the factors which can keep a site from achieving its successional potential, or "climax." We call non-climax communities which are maintained for long periods by the constant or repeated action of some external force, "persistent disclimaxes." Among such forces are fire and grazing as well as pollution and bulldozing. (There is evidence that fire and grazing acted together to maintain the American tall-grass prairie as a persistent disclimax before the white man came.)

Given this unifying approach, basic researchers seek to answer broad ecological questions using the city as a laboratory.

Man-modified communities are physiologically stressful. A vacant lot is like a desert in miniature; unshaded, with no carpet of dead leaves to trap water, it bakes by day, cools rapidly by night, and usually has a deficit of surface water. A stream polluted with sewage is deficient in oxygen and usually chemically hostile to many forms of life. In general, relatively few species take part in such communities (perhaps we should say relatively few can stand them). They thus resemble the communities of severe climates. Among climaxes and also within successional series, we know that simpler communities are likely to be less stable than more complex ones. Increasing the species diversity increases the number of checks and balances, decreasing the probability that a change in the abundance of one species will seriously disrupt the whole system. It has also been suggested that long-term association of species results in their mutual genetic accommodation to one another, and enhances the stability of the community. The component species of urban communities did not evolve together; they have been assembled recently from all over the world by accidents of commerce, and presumably have not had time to "get to know one another"

evolutionarily. All of which suggests that urban communities should be exemplary in their instability . . . but we don't really know.

And how did those species come to be recruited? In the eighteenth and nineteenth centuries, ships took on loads of soil and rock as ballast; at voyage's end this material was dumped in the harbor. Early American botanists combed the ballast-dumps and found scores of plants from all the continents growing on them in unlikely combinations. The vast majority never became established, but a few did (and are growing in every vacant lot in New York or Oshkosh today). Why were they successful, where so many others failed? And why are English sparrows and Asiatic cockroaches so much better at city life than our own bluebirds and butterflies? Why are so few urban species—plants or animals—native Americans?

Since urban environments are "new," the species that succeed in them must have been suited for that role by adaptations they evolved for life elsewhere. Thus we find desert and other drought-resistant plants make good vacant lot weeds. In general, successful urbanizers are preadapted to unstable environments—ephemeral, or widely dispersed, or both. Such species invariably have high reproductive rates, and usually excellent means of dispersal. Some of the best minds in ecology and ecological genetics—R. H. MacArthur of Princeton, E. O. Wilson of Harvard, R. Levins and R. Lewontin of Chicago, and others—have proposed conceptual models of what they call "colonizing ability." Some of their predictions have been tested in studies by H. G. Baker and G. L. Stebbins in California on pairs of closely related plant species, where one is a colonizer and the other not. In my laboratory we are trying to do the same thing with insects.

There are several reasons for the predominance of aliens in the urban flora and fauna. One is that most of North America was forested before the white man came, and there were relatively few plants here which were preadapted to the open situations man creates. Another reason is the significantly longer history of agriculture and urbanization in Europe—long enough for plants and animals to develop some additional tolerance of man through natural selection. And of course introduced species usually leave their natural enemies behind in the old country—often giving potential pests free rein to develop huge populations never seen back at home.

But we still know very, very little. At another symposium at the 1970 AAAS meetings, papers on plant population dynamics were read. How weeds behave in the city has tremendous theoretical interest, of course, but the significance of such studies does not stop there. If we understood what ragweed populations do when left alone, we would be that much closer to controlling them. Despite

the amount of raw material available, we are still very far from that humble goal.

III

Hell is a city much like London —
A populous and smoky city.
—Shelley, *Peter Bell the Third*

The mission of applied urban ecology has a more immediate meaning for most of us. The urban landscaper does not need to know *why* species survive in the city, but *which* do. The developer does not need to know how organic muck develops, or what a soil compression ratio is—only that muck is an unfit substrate to put a house on.

It is useless to “beautify” a city with trees that will soon be dead. We are learning what species are best suited to a given situation (our own Sweet Gum, fortunately, is an especially hardy species for Staten Island), and are even using plants as indicators of pollution levels. We have found that some urban species, such as the ubiquitous Tree-of-Heaven, are themselves a form of urban stress for other plants: they produce chemical inhibitors that exclude other species from growing under them. Researchers, such as F. O. Lanphear of Purdue University, are finding new “jobs” for vegetation in the city—as a filter for certain airborne pollutants, for example, or to absorb certain types of noise.

Ecological consulting is a new business that seems destined for big things. Staten Islanders are only too well acquainted with the effects of ecologically unsound development; as the new consulting firms become established, any excuse for such fiascos will disappear entirely. Several years ago a number of colleges—notably the University of Pennsylvania, the University of Massachusetts, and the University of Waterloo (Canada)—recognized the need for a systematic ecological approach to urban planning. Curricula were formulated and today these and other schools are turning out environmentally sophisticated planners and architects—an impressive lot, well represented at the Chicago meetings. The trick is to convince developers that ecological consultation is in their interest, too. (It is.) Indiscriminate clear-cutting often wastes shade for the buyer and money for the developer (home buyers are willing to pay up to 15% more for a shaded lot). Yet, ill-advised retention of weak or damaged trees, or of species with a poor probability of survival in the subdivision environment, is even worse: the home buyer pays for trees, loses them, and then must pay for their removal. Competent ecological judgment is obviously the answer to the tree-management problem! Consultants, looking more closely than the an-

cient, inadequate soil surveys on which developers and municipal agencies depend, have spotted unstable soils unable to support the houses planned for them. They could have foreseen the fires and mud slides that now bedevil southern California foothill developments.

Eco-planning is one way to prevent the spread of urban blight to newly urbanized areas and to exclude it from renewed ones. But what is urban ecology doing for those locked into the decaying inner city? As John Sinton of the University of Massachusetts said at the Chicago symposium, we cannot expect ghetto dwellers to embrace a conservation ethic that has no tangible impact on their lives. For them, wildlife means rats, pigeons, and cockroaches—and they are unlikely to share the researcher's enthusiasm for such animals, however much they have to teach us. Here is the point where urban ecology must bow to political and social action—and education.

Many of us believe that nature is necessary for the elevation of the human spirit. Perhaps this is only a subjective judgment, like so many religious or esthetic pronouncements of similar tone. But we spread our gospel at High Rock and Wave Hill, and we try to communicate to teachers our faith that man is better off among trees and grass than among bricks and garbage. To the extent that that is a biological statement, urban ecology may have some answers for us.

Why Count Birds?

During this age of social upheaval and pressing economic, political and social problems, one might well ask why reasonable adults occupy themselves with such a seemingly frivolous activity as a bird count.

There is a rationale for this activity: the records derived from the various annual bird counts are turned in to the National Audubon Society and from them to the U. S. Fish and Wildlife Service. In both offices these records are studied to see whether they reflect any specific trends in bird populations and whether these trends may reveal environmental changes. From them, scientists may assess what biological problems need further study; what are the causes for a decrease in populations of fish-eating birds; in what way have pesticides affected the populations of flycatchers and warblers; whether the "harvesting" of ducks by hunters should be increased. These may be some of the questions suggested by the study of the statistics submitted by bird watchers on annual counts all over the country.

Amateur bird watchers volunteer to help in these counts because there are not enough trained personnel otherwise available to cover the whole country. Birds on their migrations can be a reliable index to country-wide conditions and these counts have for many years provided statistics for study.

The time for the counts is set by the National Audubon Society to cover the latter part of December and the early part of January each year. According to the date assigned for the area, birders all over the nation and in Canada plan to spend one full day in the field recording each individual bird they see and/or hear. Naturally not *every* bird in an area can be found and recorded, large areas may not ever be covered, but where the count is consistently taken a trend in population density may be deduced for many areas.

For instance, in the New York City area certain species of birds adapt very well to an increasing human population, especially if these birds are tame enough to come to backyard feeders. Thus, even though we have much less area on Staten Island devoted to

fields, woodlands, and marsh, we have more gardens and more bird feeders in them to attract the birds. Therefore the density of the common backyard variety of birds has not diminished.

Some of the increasingly large amounts of oil spills along the Atlantic Coast may account for the drop in the waterbird count which has been recorded.

The establishment of "the world's largest and greatest garbage dump" in the Fresh Kills Meadows has attracted gulls from all over the east coast and may have encouraged a larger number of them to nest in the New York City area.

The introduction of certain species of birds has presented man with a bird nuisance problem. Among these species are pigeons, which soil many public buildings, and starlings of which the observers in 1908 proudly counted 44; in this year's count almost 8,000 birds were totalled.

House finches showed a gain from four to 73 in four years. As many as 200 were counted in a flock at Jamaica Bay Sanctuary. These birds can overwhelm feeders in gardens; they are particularly fond of sunflower seeds and can displace other, more seldom-seen birds which also prefer these seeds. The house finch is found in flocks in the winter, but in the spring individuals pair off. They have been found nesting at St. Paul's Avenue and Moravian Cemetery.

Bird watchers, with or without annual counts to perform, like to go out and watch birds and count them. A day spent in the field, observing and counting, is more sport to them than a day spent hunting ducks with a rifle or watching a football game on television.

—M. P. W.

Christmas Bird Count

1970

by MATHILDE P. WEINGARTNER

Sunday, December 27, 1970 dawned as a bright and sunny day with a west wind of nine miles per hour and the temperature at 20° F. Twenty-three observers started from their various meeting places and homes at sunrise. In parties of two or three, they tramped the woods, fields, beaches, and garbage dumps all day until dusk to find out which birds had not left for the warm South, or, coming from the North, had found shelter in this area. There was some ice and shallow, crusty snow on the ground. The ponds and lakes were, for the most part, frozen although some open water was visible on each.

At dawn, thousands of starlings left their roost under the St. George Ferry viaduct. Another 700 (estimated) had found shelter in a new place: the old overpass of the defunct Brooklyn ferry slips.

Feeders, such as one in Dongan Hills and another in Great Kills, proved to be gathering places for very many of those birds frequenting backyards.

The evergreen grove in one of the cemeteries was a place where a long-eared owl found refuge from its tormentors, the crows. Two horned grebes hugged the shore of Silver Lake Reservoir, and 16 common snipe probed the mud for worms on the shores and mud-flats of the partly-empty Clove Lake.

The count of bay ducks was low this year, although many more had been seen off our south shores as late as two weeks before the count. So we presume that they may have moved to another, and possibly safer, body of water. The New York City area has been rather prone to oil spills lately, and although these may not be the massive and more newsworthy ones reported from other areas, these spills do account for a considerable toll in waterfowl.

As the day wore on, the wind picked up to as much as 20 miles per hour and clouds obscured the sunshine that might have warmed the bones of the observers. The cold weather might have spurred the two monk parakeets (reported in *The New Bulletin*,

Vol. 20: 3, 5) into fortifying their roosting nest with more sticks to help break the chill winds.

The observers were Doris Barlow, Mary and Philip Benjaminson, Esther Brewer, Howard Cleaves, Robert Clermont, Gloria Deppe, Charles Fallon, Howard Fischer, Henry Flamm, Kenneth Lewis, Thomas Materfis, Anna Meyer, Michael Kantor, Celia Polomany, Edward Stonick, John Stonick, Esther Swayer, James Wagerik, Mathilde P. Weingartner, Ruth and Stanley Davis, Richard Zain Eldeen.

Listing of birds seen:

		Belted Kingfisher	3
		Yellow-shafted Flicker	3
Horned Grebe	24	Hairy Woodpecker	9
Great Blue Heron	4	Downy Woodpecker	46
Black-crowned Night Heron	36	Horned Lark	39
American Bittern	1	Blue Jay	109
Canada Goose	2	Common Crow	450
Mallard	167	Black-capped Chickadee	80
Black Duck	527	Tufted Titmouse	19
Gadwall	1	White-breasted Nuthatch	61
Green-winged Teal	85	Red-breasted Nuthatch	3
American Widgeon	7	Mockingbird	34
Greater Scaup	6,670	Catbird	1
Common Goldeneye	211	Brown Thrasher	1
Bufflehead	188	Robin	30
Old Squaw	40	Starling	7,357
Hooded Merganser	2	Myrtle Warbler	10
Red-breasted Merganser	1	House Sparrow	547
Red-tailed Hawk	9	Eastern Meadowlark	4
Red-shouldered Hawk	1	Red-winged Blackbird	160
Rough-legged Hawk	15	Rusty Blackbird	11
Marsh Hawk	9	Common Grackle	9
Pigeon Hawk	1	Brown-headed Cowbird	75
Sparrow Hawk	17	Cardinal	106
Ring-necked Pheasant	57	Evening Grosbeak	5
Killdeer	3	House Finch	73
Ruddy Turnstone	40	American Goldfinch	10
American Woodcock	2	Rufous-sided Towhee	6
Common Snipe	34	Savannah Sparrow	3
Purple Sandpiper	40	Slate-colored Junco	169
Dunlin	15	Tree Sparrow	60
Sanderling	8	Field Sparrow	8
Iceland Gull	1	White-throated Sparrow	137
Great Black-backed Gull	3,857	Fox Sparrow	16
Herring Gull	22,313	Swamp Sparrow	6
Ring-billed Gull	85	Song Sparrow	159
Laughing Gull	4	Lapland Longspur	3
Bonaparte's Gull	555	Snow Bunting	21
Mourning Dove	371	Monk Parakeet	2
Barn Owl	1		----
Long-eared Owl	1	<i>Totals:</i>	
Short-eared Owl	4	79 Species	45,254 Individuals

Natural History Records

Prepared by MATHILDE P. WEINGARTNER

ABSTRACTS from the Minutes and Field Trip Reports of the Section of Natural History and from the Minutes of the Study Group, from January 1961 through December 1969.

Code: F.T. = Field Trip Reports

S.G.M. = Study Group Minutes

W.L.R. = Wild Life Refuge

C.R. = Confidential Records

No letters after date = Section of Natural History Minutes

Weather, Astronomy, Geology

Aqueduct—H. Behm, 4/62, 2/63, 1/64, 11/65 S.G.M.

Artenite—M. Weingartner, Concord, 1/69 S.G.M.; 4/69 S.G.M.

Drought—H. Behm, 9/64

Eclipse—Cleaves, 1/64

Eclipse of Moon—P. Nelson, 12/64; 4/69 S.G.M.

Hydromagnesite—M. Weingartner, Concord, 1/69 S.G.M.

Leonids—11/66 S.G.M.

Lignite Malachite—A. Anderson, Rossville, 11/62

Sun Dogs—P. Nelson, 1/62 S.G.M.

Marine Life

Garfish—M. Weingartner, Ward's Point, 9/66 S.G.M.

Animals

Muskrat—H. Behm, Travis, 2/62

Opossum—M. Weingartner, Museum grounds, 4/63, 8/68, 1/67 S.G.M.

Raccoon—M. Weingartner, 10/62

Weasel—A. Meyer, Travis Avenue, 12/62

Insects

Black Widow Spider—M. Weingartner, Midland Beach, 9/66
Cicada Killer Wasp—A. Meyer, Bard Avenue, 8/64
Seventeen-year Cicada—4/62, 5/62
Earwig—M. Weingartner, 10/68 S.G.M.
Hummingbird Moth—P. Benjaminson, Great Kills, 6/68
Luna Moth—H. Cleaves, 8/61
Wasp—10/62 S.G.M.

Plants

American Chestnut—M. Weingartner, 2/67 S.G.M.
Blue Gentian (Closed)—Buck's Hollow, 11/63 F.T.
Ganoderma fungus—Mrs. James, High Rock Park, 5/68 S.G.M.
Ginger, Wild—Rockland Avenue, 10/63 F.T.
Goldie's Fern—Rockland Avenue, 10/63 F.T.
Growth After Fire—A. Meyer, Tottenville, 5/63
Habernaria—Betros, Tottenville, 10/63 S.G.M.
Hudsonia tomentosa—K. Nesslinger, Great Kills, 5/56; 6/68 C.R.
Hazelnut (Beaked)—Rockland Avenue, 10/63 F.T.; 4/67
Lycogala epidendron—M. Weingartner, Willowbrook Park, 10/68 F.T.
Paper Mulberry—Decker Farm, 7/68 F.T.
Polygonatum biflorum—M. Weingartner, Egbertville, 6/68 C.R.
Shagbark Hickory—Betros, Annadale, 2/61 F.T.
Sour Gum—Rockland Avenue, 10/63 F.T.
Star Solomon's Seal—Ward's Point, 10/62 F.T.
Sweet Colt's Foot—Richmondtown, R. Meyer, 4/65
Virginia Pine—Rossville, 10/6 F.T.

Birds

American Oystercatcher—Redjives, Great Kills, 5/61
Barrow's Goldeneye—J. Stonick, Wolfe's Pond Park, 12/65 S.G.M.
Bluebird—M. Weingartner, 3/63 S.G.M.; 1/64, 2/64, 10/65 F.T.
Blue-gray Gnatcatcher—M. Weingartner, 4/67 W.L.R.
Blue-winged Teal, Great Kills, 4/65 F.T.
Bobolink—M. Weingartner, Moravian Cemetery, 5/67 S.G.M.
Bobwhite—R. Meyer, Livingston, 5/61 S.G.M.; M. Weingartner, Kissell Avenue, 5/69 S.G.M.
Brant—Cleaves, Lemon Creek, 4/68
Broad-winged Hawk—Polevoy, Tottenville, 10/67
Canada Goose—A. Meyer, West Brighton, 10/65
Cattle Egret—Cleaves, Mt. Loretto, 5/62 S.G.M.
Common Snipe—Cleaves, Mt. Loretto, 3/65

Dovekie—J. Stonick, New Dorp Beach, 12/65 S.G.M.
 Evening Grosbeak—M. Stryker, Slosson Avenue, 4/63, 12/63, 11/68
 S.G.M.
 Gannet—Clermont, Lower Bay, 1/63 S.G.M.
 Glaucous Gull—J. Stonick, Great Kills, 4/65 S.G.M.
 Golden Eagle—M. Weingartner, Travis, 10/62
 Great Blue Heron—M. Weingartner, W.L.R. 4/67
 Herring Gull—Cleaves, Swinburne Island, 8/64, 7/66
 House Finch—M. Weingartner, Livingston, 4/62 S.G.M.; 4/65
 S.G.M.; 7/67
 Iceland Gull—R. Clermont, New York Bay, 1/66, 4/67 S.G.M.
 Least Bittern—Cleaves, Lemon Creek, 12/68
 Mourning Warbler—Clermont, Wolfe's Pond Park, 10/62 S.G.M.
 Nighthawk—Cleaves, Amboy Road, 8/65
 Osprey—M. Weingartner, 4/67 S.G.M.
 Pied-billed Grebe—Cleaves, Sharrott's Pond, 7/65
 Pine Grosbeak—P. Benjaminson, Great Kills, 11/67
 Pine Siskin—Cleaves, Pleasant Plains, 12/69 S.G.M.
 Pintail—Fallon, Great Kills, 2/65 S.G.M.
 Purple Martin—Cleaves, Lemon Creek, 6/61
 Purple Sandpiper—J. Stonick, Great Kills, 12/62 S.G.M.
 Red-bellied Woodpecker—M. Weingartner, High Rock Park, 11/66,
 5/69 S.G.M.
 Red-headed Woodpecker—M. Weingartner, W.L.R. 12/66, 5/68
 S.G.M.
 Ring-necked Duck—Cleaves, Sharrott's Pond, 4/65 S.G.M.
 Saw-whet Owl—Greg Loan, W.L.R. 1/66 S.G.M.
 Short-eared Owl—R. Meyer, Great Kills 11/63 S.G.M.
 Snow Goose—(10,000)—J. Stonick, Great Kills, 11/63
 Snowy Egret—M. Weingartner, W.L.R. 5/63
 Snowy Owl—Taylor, 10/62, 2/67
 Tufted Titmouse—Redjives, Eltingville, 5/61
 Willet—Great Kills, 4/65 F.T.
 Wilson's Petrel—J. Stonick, off Mt. Loretto, 4/65, 8/65
 Winter Wren—L. James, Buck's Hollow, 2/68
 Woodcock—J. Stonick, Richmondtown, 12/62 S.G.M.
 Wood Duck—Clermont, Acme Pond, 4/63, S.G.M.; 6/68
 Yellow-crowned Night Heron—Fischer, High Rock, 5/68

ABOUT OUR CONTRIBUTORS

F. Gordon Foster is a retired Member of the Technical Staff of Bell Telephone Laboratories. He has a degree of Bachelor of Science in Mechanical Engineering (Newark College of Engineering) and has studied metallurgical engineering at Polytechnic Institute of Brooklyn and electron microscopy at Stevens Institute of Technology. He also taught at the Newark College of Engineering as well as at Stevens Institute. A licensed professional engineer in New Jersey, he is past chairman of the Committee on Microscopy, American Society of Testing and Materials. He is a Fellow of the following: Royal Photographic Society of Great Britain, Royal Microscopical Society, and a member of Sigma Xi. He has received awards for his microscopical work from the American society for Metals and the American Society for Testing and Materials. He received the Ashby plaque of the New York Microscopical Society in 1956. Earlier he had become interested in the study of ferns through the microscopy of their spores. He has lectured and written on the subject, as well as has grown many native and exotic species. He recorded the various stages of plant growth from spore to mature plant by color photography and photomicrography. Among his many writings on the subject was *The Gardener's Fern Book* which was published in 1964 by D. Van Nostrand Company. He is a member of the American Fern Society, the British Pteridological Society and the Los Angeles International Society.

Arthur M. Shapiro is an Assistant Professor of Biology at Richmond College, specializing in insect ecology. He received his B.S. from the University of Pennsylvania and his Ph.D. from Cornell University, where he worked on food plant selection by butterflies. He has been a research assistant to the Philadelphia Academy of Natural Sciences and the Laboratory of Genetics, Oxford University, and is a frequent contributor to entomological journals.

Mathilde P. Weingartner is Curator of Science for the Staten Island Museum as well as Curator of the William T. Davis Wildlife Refuge. She has been the author of many articles printed in previous *Proceedings* and in other scientific publications. She is the author of *The Staten Island Walk Book*.

BOOKS RECEIVED

Basic Thermodynamics by A. S. Morton and P. J. Beckett. Philosophical Library. 1970

Life as Revealed by the Microscope by L. Conel. Philosophical Library. 1970

Handbook of Atomic Elements by R. A. Williams. Philosophical Library. 1970

Our Environment Can be Saved by Nelson A. Rockefeller. Doubleday. 1970

Especially Maine: The Natural World of Henry Beston from Cape Cod to the St. Lawrence by Elizabeth Coatsworth. Stephen Greene Press. 1970

North American Indian Arts (A Golden Science Guide) by Andrew Hunter Whiteford, Herbert S. Zim. Vera R. Webster, General Editor, and illustrated by Vernon Shaffer. Golden Press. 1970

Environment and Man by Richard H. Wagner. W. W. Norton & Co., Inc.,—"printed on recycled paper." 1971

PROCEEDINGS

Staten Island Institute of Arts and Sciences



CONTENTS

Articles

- | | | | |
|---|------|------------------|----|
| WORT'S FARM EXCAVATION | 1969 | Jonathan Horwitz | 35 |
| <i>Contribution Number 5 of the Metropolitan Area
Archaeological Survey</i> | | | |
| THE EUROPEAN SKIPPER COMES TO STATEN ISLAND | | | |
| Arthur M. Shapiro | | | 45 |
| VARIATION IN AULACODISCUS FUGEI BARKER AND MEAKIN | | | |
| Joseph F. Burke and A. L. Brigger | | | 50 |
| THE MONK PARAKEET INVADES STATEN ISLAND | | | |
| Howard H. Cleaves | | | 53 |
| <i>A Review of Two Environmental Handbooks</i> | | | 58 |

Editor: G. K. Schneider

Published October 1971, in its ninetieth year, by The Staten Island Institute of Arts and Sciences, 75 Stuyvesant Place, Staten Island, New York 10301.



Wort's Farm Excavation 1969

*Contribution Number 5 of
The Metropolitan Area Archaeological Survey*

by JONATHAN HORWITZ

The excavation of the Wort Farm Site (Std. 2-3) was continued in 1969 by students in field archaeology at Columbia University under the direction of Dr. Shirley Gorenstein. The site is located in Rossville, west central Staten Island, in the southwest section of a block of land bordered by Barry Street to the north, Woodrow Road to the south, Rossville Avenue on the east, and Winant Avenue on the west. The area was originally surveyed by Skinner (1909:10) in the early years of this century. More recently, work has been done in 1963 (Jacobson, nd), 1964 (Barritt, 1964), 1966-67 (Williams, 1968) and 1968 (Deustua, 1969). In 1969 three five-foot square trenches (designated CUWF V, VI, VII) were excavated in Area A. A similar trench was opened in Area B, but it was soon abandoned as the results were minimal and the manpower was needed in Area A.

The stratigraphy of Area A contains three main levels. The top level, the plow zone, is covered with 2 inches of charcoal dust from a fire in 1963, and humus. The plow zone is 7" to 12" deep, and consists mainly of a brown sandy soil, with a heavy concentration of roots. Underlying the plow zone is a layer of undifferentiated yellow sand. Roots extend as far as 15" into this layer which is between 25" and 35" thick. Beneath the layer of sand is a layer of red clay, 2" to 8" thick, at the bottom of which is yellow-and-white mottled gravel. Previously, the only layers thought to contain cultural material were the plow zone and the yellow sand.

The artifacts from the excavation in 1969 fall into four broad categories: core artifacts, flake artifacts, blades, and completely bifacially retouched and chipped tools. No clay artifacts were recovered in 1969.

THE CORE ARTIFACTS

The core tools are made of large pebbles which are no larger than what can be comfortably held in one hand. The largest is 9.4 cm long, 7.9 cm wide, and 4.1 cm thick, while the smallest is 5.7 cm long, 6.0 cm wide, and 3.3 cm thick. Attributes are the result of use, such as a pecked surface, the byproduct of hammering, or fashioning such as the removal of a few flakes from a core. Of the four core artifacts found all are tools: two are hammerstones and two are choppers. All four were found in Trench VII. Perhaps the most important aspect of these core tools is that three of them were found well within the red clay layer, which was previously considered to be sterile.

Choppers. One of the choppers was found in the red clay. It is made of a gray sandstone and measures 9.1 cm long, 8.0 cm wide, and 3.5 cm thick. Several flakes have been knocked off one end to produce a rough cutting edge.

The other chopper was found in the screening of the plow zone. It is brown chert and it is slightly larger than the other measuring 9.4 cm long, 7.9 cm wide, and 4.1 cm thick. Flakes have been struck off to form the cutting edge, which shows retouch.

Hammerstones. The two hammerstones were found in the red clay. The larger of the two is a piece of angular yellow sandstone with heavy pecking at one corner. It measures 7.9 cm long, 5.4 cm wide, and 3.7 cm thick.

The other hammerstone is a rounded brown quartzite pebble. Flakes have been struck at one end as a result of pecking. They have not been removed in order to create a chopping edge. Since there are no signs of use on this edge, it seems likely that this tool was not used as a chopper. It measures 5.7 cm long, 6.0 cm wide, and 3.3 cm thick.

Aside from these core tools, three other pieces of lithic material were recovered which may have been cores from which flakes were struck. One came from the screening of the plow zone of Trench VI, and may have been damaged by recent plowing. It is an irregularly shaped piece of buff colored chert, 4 cm long,

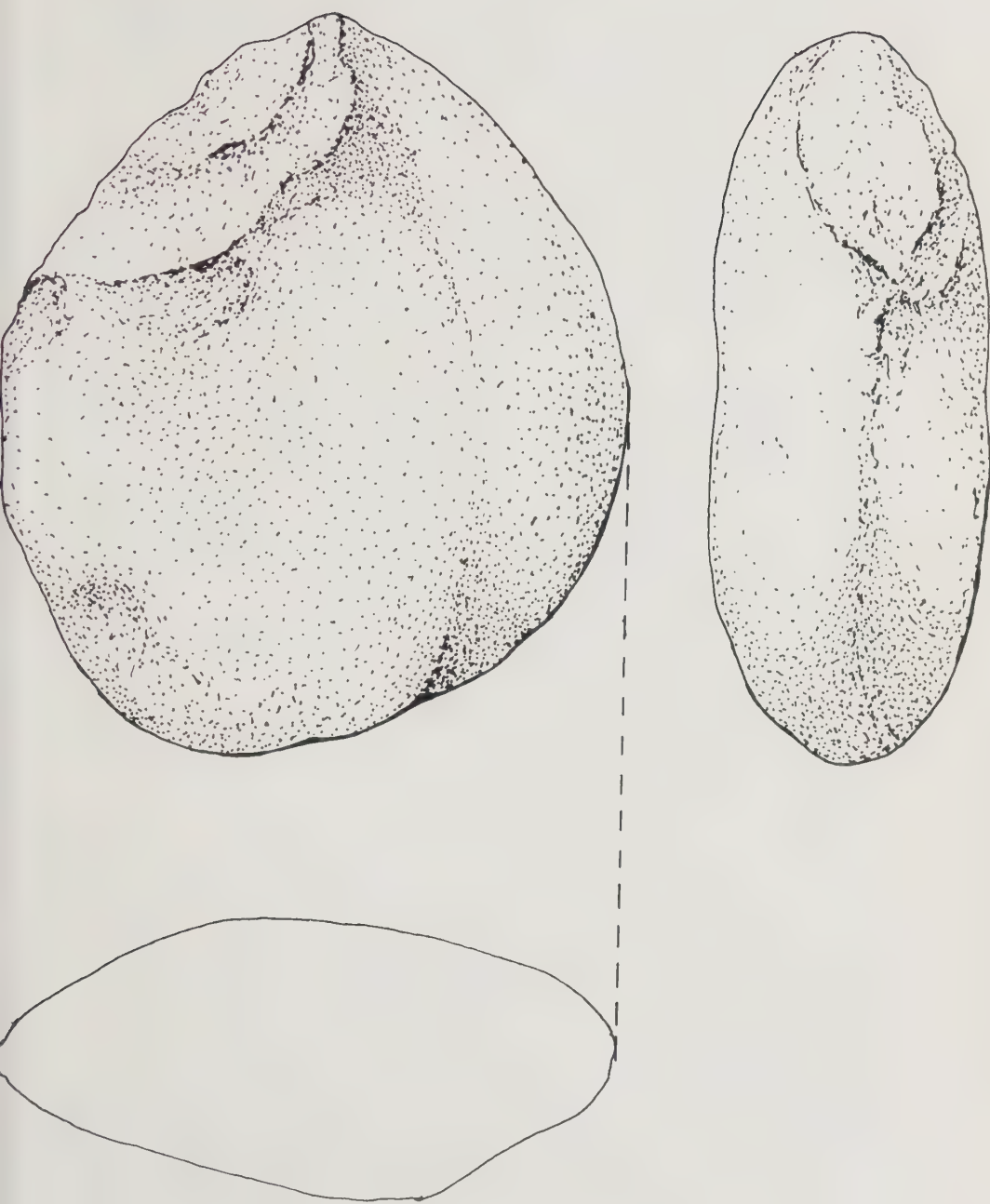


fig. 1—Chopping tool from red clay, Trench VII (drawn to scale)

2 cm wide, and 1.5 cm thick. It has a pecked surface indicating that it may have been a hammerstone. The other two both came from Trench VII, one found 10.5" below the surface, the other 6" below. The latter is an unworked polyhedral core, except for one edge which has a graver. The other, a beige chert pebble, has a negative bulb of percussion, where one flake was struck. It displays no other signs of use.

THE FLAKE ARTIFACTS

The flake collection has been divided into two categories: utilized flakes, and non-utilized flakes. From a collection of 38 flakes, 26 are utilized, that is, showing use or wear retouch, and 12 are non-utilized. Twenty-eight flakes are of chert, and 10 are of argillite.

Utilized Flake Tools. There are several large flake tools. The largest of the collection is a chopper found in Trench V, 19 inches below the surface. This chopper, roughly triangular in shape and made of a buff-colored sandstone, measures 9.8 cm long, 7.8 cm wide, and 3.4 cm thick. The striking platform and the bulb of percussion are clearly visible. Along the cutting edge on the dorsal side signs of wear are distinct.

A trapezoidal flake with three sharp cutting edges was found about 15 inches below the surface of Trench V. As a result of heavy weathering only very definite signs of work remain. Two of the cutting edges are heavily denticulated and the bulb of percussion has been removed. It measures 6.6 cm long, 4.7 cm wide, and 1.2 cm thick.

A scraper of fine conglomerate, the only artifact of this material in the collection, was found in Trench V. Roughly pentangular in shape, it measures 5.8 cm long, 4.9 cm wide, and 1.7 cm thick. The ventral surface is slightly concave, while the dorsal face is basically pyramidal. The bulb of percussion has been removed, and there is some evidence of wear on all edges. This scraper was found some 15.5 inches below the surface.

The last of the larger flake artifacts was found 22.5 inches below the Trench VII surface. It is made of gray siltstone and measures 5.5 cm long, 5.6 cm wide, and 1.6 cm thick. The material is quite weathered. The shape is trapezoidal and the dorsal and ventral surfaces are parallel. One edge is formed by a bevel from the dorsal to the ventral face. There is an indication of a bulb of percussion; however, the weathered condition of the stone



fig. 2a



fig. 2b



fig. 2c

fig. 2—Three projectile point types from Wort's Farm (drawn to scale)

a—Argillite Bare Island point

b—Chert Madison point

c—Chert Levanna point

(drawn by J. Hammond)

makes positive identification impossible. In fact, identifying this tool would be very difficult if it were not for the existence of two smaller, but nearly identical artifacts. Though they are more triangular in shape, their surfaces are parallel and each has a sharp bevelled edge. One of these smaller ones is made of gray argillaceous sandstone, is badly eroded, and measures 3.9 cm long, 3.1 cm wide, and .8 cm thick. The other is identical except that it is made of red siltstone. These three tools I group together as bevelled edge scrapers.

There are six argillite flakes which show definite signs of wear. Three of them are more or less the same size and shape of large kidney beans, yet this shape seems to have little to do with their function as the heaviest signs of wear on the largest is on the convex edge, while the signs of wear on the two smaller ones are on the concave edge and the butt end respectively. The two larger ones have striations perpendicular to the edges. The fourth argillite flake, basically oblong in shape, has striations which are diagonal to the edge. Another argillite flake, basically trapezoidal, shows striations on all four edges, but only three are cutting edges. The ventral side also has many striations, often running at angles to each other, make a crosshatching pattern. The last utilized argillite flake is a small spatula-shaped piece which shows many striations on both dorsal and ventral surfaces, as well as on three of the four edges.

The remaining utilized flakes are all made of chert. Two of these are denticulated. The larger of these two measures 4.3 cm long, 2.9 cm wide, .7 cm thick, and was large enough to be used by hand, while the smaller only measured 1.7 cm long, 1.5 cm wide, and .4 cm thick, and must have been hafted in some way to be of any use. A third was a burin on a snapped crude blade, while another shows use-retouch and deliberate chipping on the ventral surface, especially around the bulb of percussion.

The remaining eight chert flakes show signs of use along their edges, but no indications of deliberate retouch.

Non-utilized Flake Tools. There are 12 non-utilized flakes, four of argillite and eight of chert. None of these flakes show any signs of use or retouch, yet all show that they are the result of man's work. In the case of argillite, its mere presence is proof enough, as this material is not indigenous to Staten Island (Rutsch 1968: 77). Two of the chert flakes fit together, but this is of little help as neither the core nor other fitting flakes were found.

THE BLADE TOOLS

There are 10 blades in the collection, six of chert and four of argillite. The largest chert blade is 3.3 cm long, 2.3 cm wide, and .45 cm thick. It was found in Area B while screening. The smallest is 2.1 cm long, 1.1 cm wide, and .2 cm thick. Of the six chert blades, three have cortex and five show definite signs of use. One of the blades is considerably finer than the others. It is a trihedral piece of buff-colored chert, and measures 3.0 cm long, 1.3 cm wide, and .2 cm thick. It has a large striking platform and a diffuse but clear bulb of percussion with a large bulbar scar. There is one dorsal ridge which runs from the base to the tip. The terminal end of the blade is excurvate in relation to the ventral surface, and may well have been used as a graver since there are signs of wear on both edges.

The argillite blades pose a special problem because the material weathers considerably, making many details impossible to distinguish. The basis for selection into this group is mainly by shape, and, regrettably, a somewhat abbreviated definition of *blade* is used: a piece of argillite twice as long as it is wide. Three of the four argillite blades were found in Trench VI, the fourth in Trench VII. All were found *in situ* between 14.5" and 24" below the surface. The smallest seems to be a unifacially worked blank for a projectile point, possibly of the Lamoka type. The other three are all knife shaped.

BIFACIALLY WORKED TOOLS

Seven bifacially worked artifacts were found. No signs of the cortex, striking platform, or bulb of percussion remain. Six of the artifacts are chert, the seventh is argillite. The argillite artifact is a Bare Island point (Ritchie, 1961: 14-16). The shape of the blade is that of a slender isosceles triangle, the edges are straight, and the tip is broken. Its stem has straight parallel edges, and the base is straight. The cross section is oval. Interestingly, there are many striations on the point which run diagonally to the long axis. This may indicate that even these early points were ground, due to the softness of the material; however, Bare Island points of other (more durable) stone are chipped. This point is 3.9 cm long, 1.7 cm wide, and .6 cm thick. It was not found *in situ*.

Two of the chipped chert artifacts are not projectile points. The larger of the two measured 3.7 cm long, 2.7 cm wide, and 1.0 cm thick, and is of black chert. It is roughly triangular in

shape, with a concave base. On general appearance, it would seem to be a projectile point, but its thickness would exclude such a use, and the longer, slightly convex edge shows signs of wear indicating that it probably was used as a scraper. It was found 13.5 inches below the surface in Trench V. The other artifact is a small crescent-shaped piece of dark red chert. It has been purposely snapped, leaving two sharp projections which both show signs of wear. The single sharp cutting edge also shows signs of wear, but whether this was caused before or after snapping cannot be known.

Three of the chert projectile points are of the Levanna type (Ritchie, 1961: 31-32). All of these were found in Trench VI, one in the screening, one at a depth of 11 inches, and the last at 14.5 inches below the surface. These points are very thin lens-shaped in cross section, tapering down to fine edges, which are straight. The basal thinning is well executed, and the base is concave. The largest is 2.95 cm long and 2.55 cm wide, while the smallest is 2.65 cm long and 2.4 cm wide. All are .4 cm thick.

The fourth chert point is of the Madison type (Ritchie, 1961: 33-34). This finely chipped point is 3.2 cm long, 2.2 cm wide, and .4 cm thick. The edges are very slightly concave as is the base. The cross section is a flat oval. This point was found in screening the plow zone of Trench V.

SURVEY

A survey of the area some two hundred yards east of Area A was also carried out in the spring of 1969. A large number of waste flakes were found. They were mostly of buff and gray chert. A chert core from which several flakes were struck showed step flaking, indicating direct percussion with a hammerstone. Also found was a scraper of buff chert. It was bifacially worked. An excellent example of a thumbnail scraper was also found. This small, triangular piece of red chert is completely worked on the dorsal surface, but not at all on the ventral. The edges show a very steep retouch as well as signs of wear.

A test trench was started in this area. Its total yield was two unretouched, non-utilized flakes, and clearly showed that the soil in the area was quite disturbed.

CONCLUSIONS

The 1969 excavations do not, unfortunately, shed light on any of the questions raised by Williams (1968) concerning Archaic oc-

cupations of the site; however, they do tell us something of the transition from the Archaic to the Woodland.

Noting that Bare Island, Bare Island variant, and Bare Island-Poplar Island Intergrade recovered at depths varying from 17 inches to 22 inches below the surface, and that "... associated, by depth, with these points were the majority of argillite knives and perforators ..." Williams goes on to say "... thus in Area A a well defined Bare Island occupation zone can be delimited (1968:46)." As Bare Island points can be assigned to the Late Archaic (Kinsey, 1961:15), so too can this zone. Likewise, Williams delimits the Woodland occupation zone as being from a depth of above 14 inches to the surface on the basis of pottery, the Madison and Levanna projectile points, and the Steubenville Stemmed point which were all found in this zone.

Although the only Bare Island point from the 1969 excavations was found out of context, the depths of other argillite artifacts ranged from 14.5 inches to 24 inches below the surface. If indeed argillite artifacts can be associated with Bare Island occupations, then it would seem that the Late Archaic is represented to a depth of 14.5 inches. To complicate matters, however, is the Levanna point which was also found at a depth of 14.5 inches.

As the Levanna point can be assigned to the Woodland (Ritchie, 1961:31), the Woodland can be definitely established to a depth of 14.5 inches. However, the argillite flakes can have no such positive assignation, and we can only hypothesize that the Bare Island occupation zone of the Late Archaic extends up to that level.

The Wort Farm site represents a hunting camp, recurrently occupied, probably on a fairly regular basis, as is evidenced by the relative continuity of artifactual materials.

Future excavations should be aimed at examining the Archaic-Woodland transition, especially what seems to be the key zone—that is from 14.5 inches to 17 inches below the surface. The presence of the chopper and the two hammerstones in the red clay also opens new vistas for investigation. Whether or not these tools mean that early man occupied this site can only be shown after further investigation.

Bibliography

Barritt, Rex

- 1964 Wort Farm Archaeological Excavations. *The New Bulletin*, v. 14, No. 3, pp 27-33. Staten Island Institute of Arts and Sciences.

Deustua, Patricia N.

- 1969 The 1968 Season at the Wort Farm Site, Staten Island. *Proceedings*, Staten Island Institute of Arts and Sciences 24:3: 58-60.

Kinsey, W. Fred III

- 1961 "Bare Island Points" in *Typology and Nomenclature for New York Projectile Points*, W. A. Ritchie, pp 14-15. New York State Museum and Science Service, Bulletin No. 384. Albany.

Ritchie, William A.

- 1961 *Typology and Nomenclature for New York Projectile Points*, New York State Museum and Science Service, Bulletin No. 384. Albany.

Rutsch, Edward S.

- 1968 A Petrological Study of Aboriginal Projectile Points from Staten Island. *Proceedings*, Staten Island Institute of Arts and Sciences 23:3: 75-81.

Skinner, Alanson

- 1909 The Lenape Indians of Staten Island. *Anthropological Papers* of the American Museum of Natural History, Vol. III, pp 3-62. New York.

Williams, Lorraine

- 1968 The Wort Farm: A Report on the 1963-1964 Excavations. *Proceedings*, Staten Island Institute of Arts and Sciences 23:2: 39-52.

The European Skipper Comes to Staten Island

by ARTHUR M. SHAPIRO

Most of the urban biota consists of naturalized aliens. This is no less true for butterflies than for, say, weeds. Of the two commonest Staten Island butterflies one, the Orange Sulphur (*Colias eurytheme*) is adventive from the southwestern United States, and the other, the European Cabbage Butterfly (*Pieris rapae*) arrived in North America some 110 years ago and quickly took over the continent. Now another European species—an inconspicuous animal named *Thymelicus lineola*—seems destined to rank with them in abundance here.

The European Skipper, as American naturalists have dubbed it (the British call it the Essex Skipper; the Germans, Schwarzkolbiger Dickkopffalter; the Spanish Dorada linea corta), shows little of the aggressiveness in its home territory which has distinguished it on this side of the ocean. It ranges widely across Europe south of 62° N. Lat., east to Amurland and west to southeastern Britain, but it is seldom very abundant. No one knows how it came to be found at London, Ontario in 1910. From there it spread slowly into Michigan and northern Ohio and east to near Buffalo, New York. In the 1950s it somehow jumped to the Piedmont in Pennsylvania—where it never “caught fire,”—and New Jersey, where it did. From Lebanon, Hunterdon County, it spread in all directions to take possession of the entire Garden State in just over a decade. It also reinvaded Pennsylvania from the east, occupying the southeastern corner after 1965 and apparently the northeastern corner shortly thereafter. Isolated colonies appeared in Connecticut and even in New Brunswick. But still the skipper was unreported from downstate New York.

Since 1968 the European Skipper has appeared in abundance throughout central New York, but due to the lack of collecting in many counties it is impossible to say for sure if these aggressively expanding populations came from the long-standing range in southwestern New York or from New Jersey, via the Poconos. Collecting in 1971 has shown that the skipper is now continuously distributed from the Great Lakes to southern New Jersey—including Staten Island.

Thymelicus lineola, although hitherto unreported in the city, was found in Richmond, Queens, and Kings Counties this year and was common and widespread enough that we must conclude it has been present and building up in numbers over several seasons. It was also found this year in Rockland, Westchester, and Orange Counties. The accompanying map (figure 1) shows the locations on Staten Island where *T. lineola* has been found. Populations in Stapleton and at Mount Loretto were substantial, especially the latter. The European Skipper feeds on hay grasses, especially timothy, and may do significant damage when populations become very dense. In Ontario and Michigan during the 1960s, tremendous outbreaks of millions of these skippers occurred. These seem to have subsided, but some of the New Jersey populations are in the outbreak phase now and we may expect similar outbreaks here within a few years.

<i>Location</i>	<i>Abundance</i>
1 Clermont Ave. & Aspinwall St., Tottenville	++
2 Finlay & Billipp Aves., Tottenville	++
3 Mount Loretto, Pleasant Plains	+++
4 Saint Michael's Home, Arden Heights	++
5 Richmond & Klondike Aves., New Springville	+++
6 Bradley & Brielle Aves., Sea View	++
7 Richmond Ave. & Jules Dr., Graniteville	++
8 Swan & Homer Sts., Stapleton	+++
9 Walker St. & Granite Ave., Mariner's Harbor	+
10-11 Forest Ave. between Morningstar Rd. & Maple Pkwy., Mariner's Harbor	++
12 South Ave. & Gooding St., Mariner's Harbor	++
13 Port Ivory	+

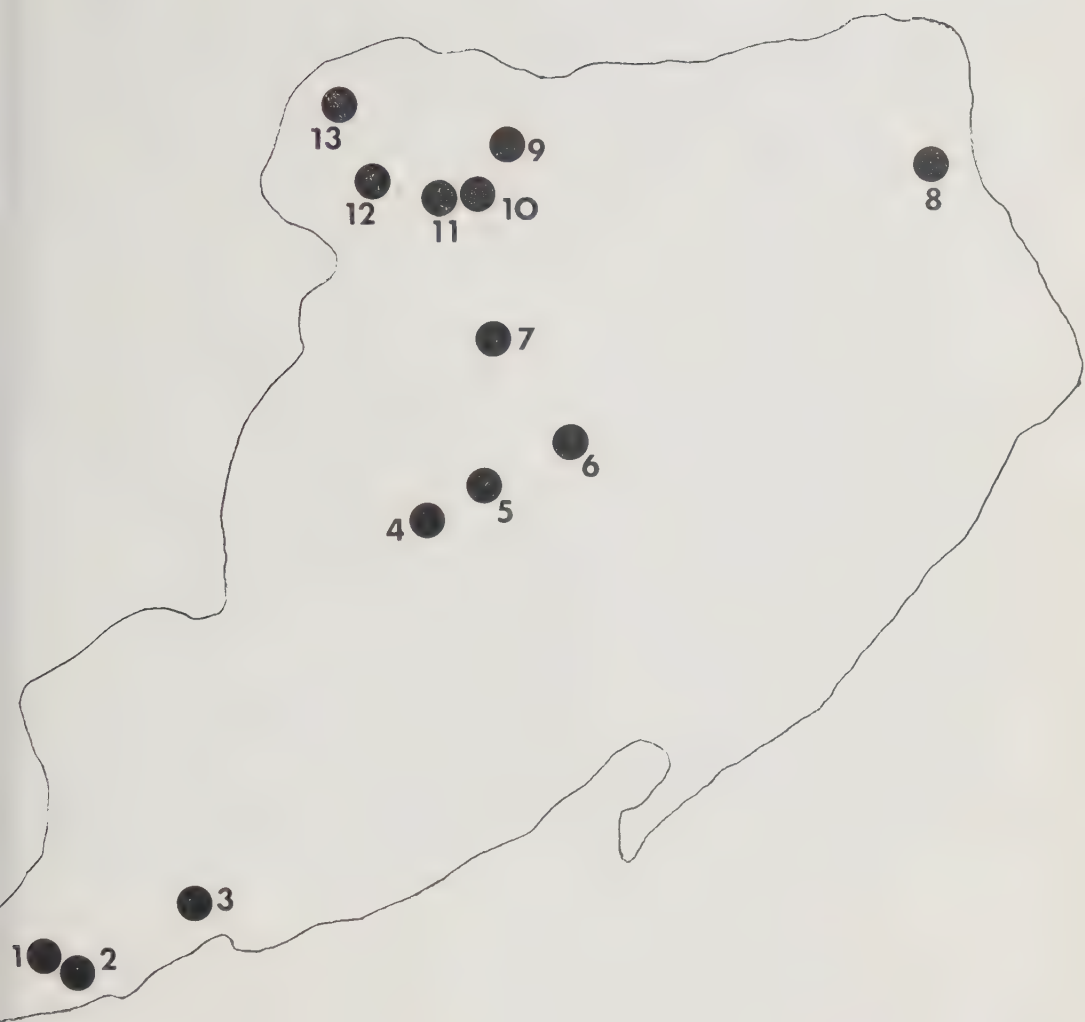


Fig. 1. *Distribution of the European Skipper on Staten Island, 1971*

In each case it appears that a slow buildup to a threshold density is needed to trigger the population explosion, perhaps abetted by genetic adaptation to local conditions over several generations during the buildup phase.

The European Skipper (figure 2) is warm orange-brown with few markings and a wingspread of just under an inch on the average. The female is slightly stouter and paler than the male and lacks the fine dark line in the middle of the dorsal forewing which contains the male scent apparatus. Both sexes fly in a single brood from late May to mid July in pastures, grassy fields, and vacant lots. They flash golden in the sun as they dart among the tall grasses, and are ardent visitors to such flowers as blue vetch, dogbane, Canada thistle, and bird's foot trefoil. The eggs are tucked in at the base of a grass blade in short rows, a habit not shared by any of our native skippers.

We have three indigenous skippers on Staten Island which resemble *T. lineola* in having a clear, unmarked yellow hindwing beneath. The Least Skipper (*Ancyloxipha numitor*) has a mostly brown forewing above and a heavy brown hindwing border on the same surface. The Arogos Skipper (*Atrytone arogos*) is very local, and has only been seen here on the grounds of Sea View Hospital. The male has a heavy brown border on all wings on the upper-side, and the top of the forewing is more pointed. The female is mostly brown above. The Delaware Skipper (*Atrytone logan*) is fairly common at Tottenville; both sexes resemble the male Arogos Skipper but are much larger, and the dark border is more contrasting. None of these skippers has the sex-mark in the middle of the forewing of the male.

Several local specimens of the European Skipper are being deposited in the Staten Island Museum.

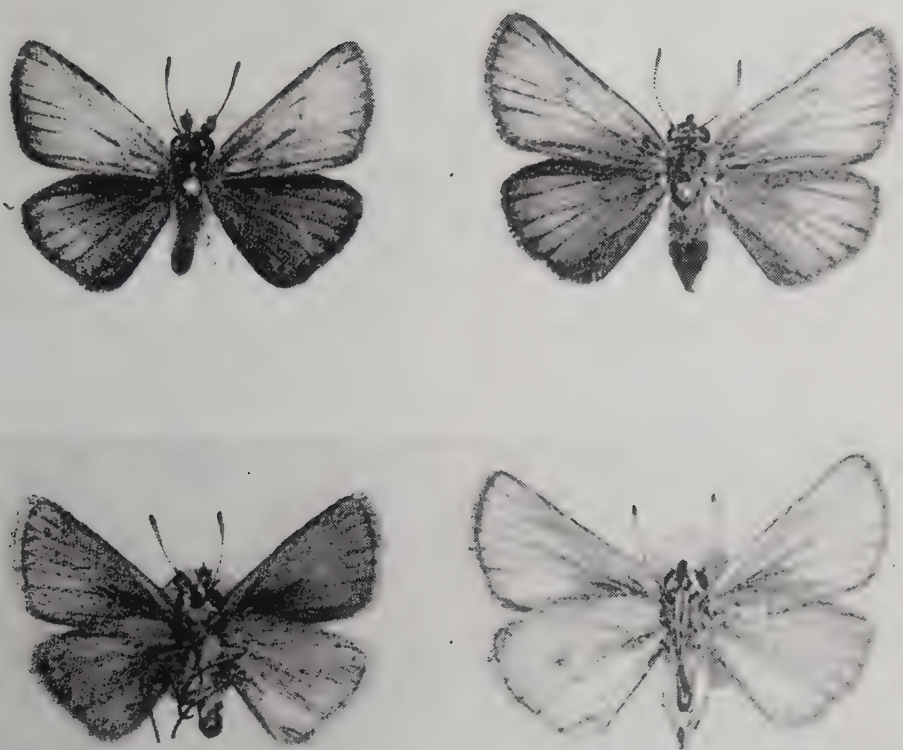


Fig. 2. The European Skipper.
Top: upper surfaces. Bottom: lower surfaces.
Male at left, female at right.

Variation in *Aulacodiscus fugei*

Barker and Meakin

by JOSEPH F. BURKE and A. L. BRIGGER

This species was described and published under the date of April 25, 1947, as from the Moreno shale in the state of California. At time of publication it was indicated as rare. The figure that accompanied its description is similar to that in the present *fig. 1*.

Shown in *fig. 2* is a specimen that lacks the maculations appearing in *fig. 1*. The other characters are similar. A third specimen is shown in *figs. 3 and 4*, at an upper and a lower focus. This third specimen is transitional from that in *fig. 2*, but comparison with *fig. 1* indicates considerable variation therefrom.

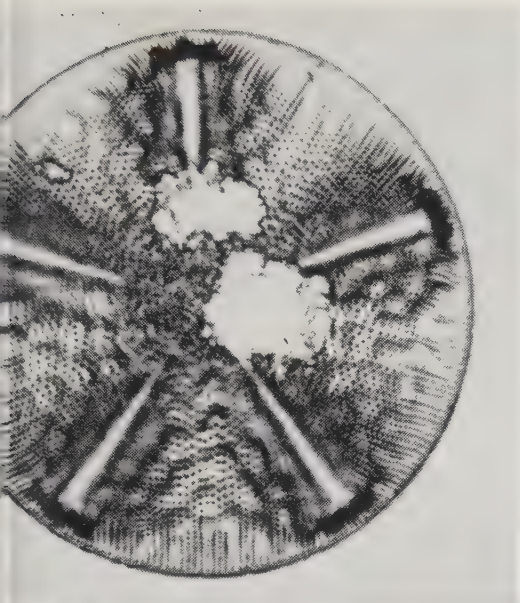
Maculated specimens, as shown in *fig. 1*, are scarce and cannot be regarded as the more usual form of the species. Rather than the maculations—persisting to some extent in most specimens—attention should be paid to the parallel dark lines between the processes. Close examination shows they are not strictly parallel nor are the rows of areolae between them. They are slightly convergent and seem to come to a focal point in space outside the margin of the valve.

In *fig. 1* is shown another character to be observed in varying degree on most specimens. On either side of the process is a short "horn" which is not equally evident at each of the processes of any one specimen.

The three specimens figured do not exhaust all of the variations in this species, but most specimens bear comparison to one of the three illustrated.

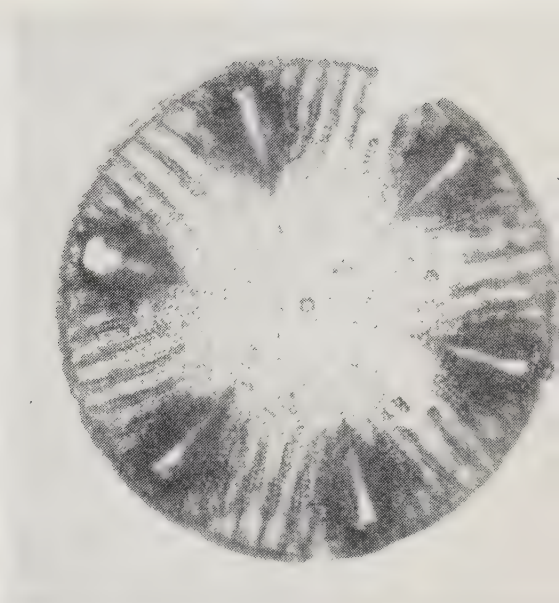
The locality given by Barker and Meakin, as the source of their specimen, may be in error. Considerable searching of California material has produced this species from the Eocene in the Kreyenhagen shale. Records from the Moreno shale, which is Cretaceous, are questionable.

AULACODISCUS



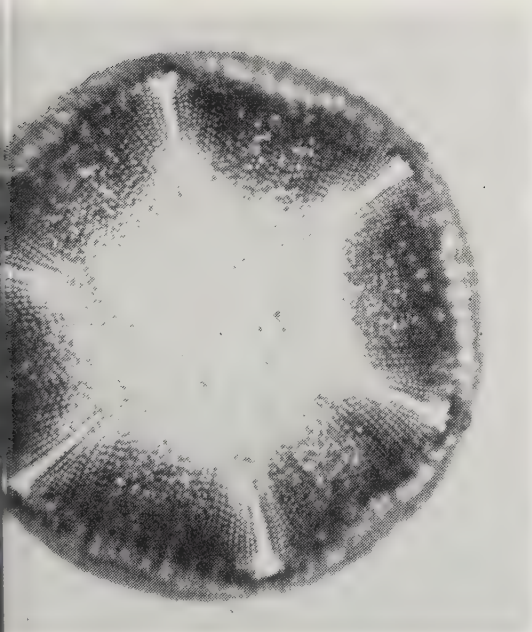
1

205 micron



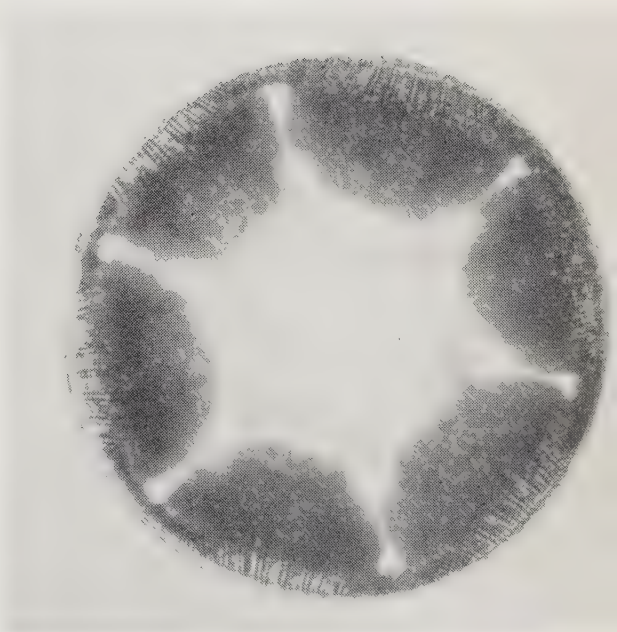
2

150 micron



3

165 micron



4

Aulacodiscus fugei Barker and Meakin
Kreyenhagen Shale, Fresno, County, California

References

- Barker, J. W. and Meakin, S. H. (1947). *The Journal of the Quekett Microscopical Club*, ser. 4, vol. 2, p. 143, pl. 22, fig. 1 (December, 1946), published April 25, 1947.
- Burke, Joseph F. and Woodward, John B. *A Review of the Genus Aulacodiscus*, Staten Island Institute of Arts and Sciences, Staten Island, N. Y., p. 31 (1964), pp. 131, 154 (1967) and (by Joseph F. Burke) pp. 281, 283 (1970).

The Monk Parakeet Invades Staten Island

by HOWARD H. CLEAVES

A beautiful exotic bird from South America, the Monk Parakeet is establishing itself over a wide area in the New York City region including Staten Island. The bird's natural range covers several South American countries among them Brazil and Argentina where its behavior, and particularly its nesting habits, have been observed by ornithologists. The Monk Parakeet is approximately the size of our native Mourning Dove, about twelve inches in length, but presenting a quite different contour due to a much larger head and shorter neck. In color the Monk Parakeet eclipses the Mourning Dove being bright green on the back with dark blue-black wings. Its throat, breast, and belly are a delicate gray, the gray hood probably explaining the bird's name, suggesting the headgear of a monk. Other names by which the species is known are Gray-breasted and Quaker Parakeet.

The Monk Parakeet did not come here on its own, but was transported by airplane to Kennedy Airport where a number of shipments had been received on orders from pet shops and aviaries. A crate containing a number of the birds is said to have been dropped during unloading, with the result that the container broke open and the parakeets took off in all directions. This occurred perhaps three years ago. Since then, sightings by bird watchers and others have been reported from many localities in western Long Island, in parks in New York City including Battery Park, and from northern New Jersey.

The presence of the Monk Parakeet on Staten Island was called to the writer's attention by Mr. Alexander E. Kopetschny of 846 Page Avenue, Richmond Valley. He had noted the birds taking food such as suet and sunflower seeds at his window feeding-shelf and pendent feeding devices. This occurred in 1970, at which time it was discovered that the parakeets had constructed a bulky nest of twigs near the top of a spruce tree in the yard of Mr. William Crane, just west of the Kopetschny place. In November, the beginnings of a second nest were discovered resting atop a screen outside the attic window of the Crane house.

The birds entered the nest from the bottom, climbing to the nest chamber up a vertical shaft. The nest consisted entirely of twigs bitten from trees and shrubs by the birds with their sturdy beaks. These twigs averaged an estimated twelve to sixteen inches in length and about a quarter of an inch in diameter at the base. I witnessed a bird bite a twig from a mulberry tree and carry it to the nest. They used twigs from arbor vitae, blackberry, and many other species of plants and trees as well. In late June 1971 this nest was dislodged by a violent storm and reported by Mrs. William Crane to contain six eggs, four of which were broken, one cracked, and one intact except for a small hole in the side. This egg I preserved in formalin and presented to the American Museum of Natural History, the only egg of this species in the Museum's possession.

When this nest was blown down by the storm, its size amazed everybody. A large wheelbarrow could hardly have held all of it. In their native Argentina, nests built by Monk Parakeets are at times so large that trees or large branches collapse under the weight, such nests being occupied by several pairs of parakeets simultaneously and communally.

The parakeets built another nest on a fire escape four floors above the ground on the west end of St. Elizabeth's School for girls at Mount Loretto, Pleasant Plains, Staten Island. One of the girls caught a parakeet at this nest, got into an argument over it with another girl, with the result that the bird lost its tail. The captor confined the bird in a cage for about three weeks. The parakeet, because of its small size, was assumed to be a young one. This assumption proved incorrect, when it was reported that the bird had laid an egg which only an adult bird can do.

Possibly the best informed person with regard to the Monk Parakeet is John Bull who is revising the large volume *The Birds of New York State* at the American Museum of Natural History. Mr. Bull informs me (late July 1971) that Monk Parakeets produced two



Nest of Monk Parakeet, *Myiopsitta monachus*, on window screen
at the home of William Crane, Richmond Valley,

(*Photograph by Philip Benjaminson, Staten Island, N. Y.*)

young in a nest at Valley Stream, Long Island, this year, of which one died, the other being at present kept in captivity by Mr. Bull and his wife. The bird is in good condition and doing well. Perhaps our Staten Island parakeets will eventually produce young. There is some speculation that the species might become a pest by an increase in numbers, but if this happens we shall have the satisfaction of harboring a much prettier bird than either the Starling or the English or House Sparrow.

The Monk Parakeet is reported to feed its young by regurgitation, its natural food probably consisting of fruits and berries. The bird is a rapid flyer and when two or more individuals are present they act in split-second synchrony in take-off and during flight. They are at times quite vocal, both while flying and when perching, their notes having a wheezy, metallic quality and being uttered with rapidity. When two birds are in or near the nest they may be heard engaged in what sounds like low, twittering conversation. I have not heard these birds emit the loud, jarring squawks characteristic of some of the larger parrots.

Addenda: The following was reported over the telephone by Howard Cleaves to the Editor: On September 1, 1971 Mr. Cleaves observed nine Monk Parakeets, including two young ones, in a communal group in a tree near the foot of Page Avenue, Staten Island, N.Y. The birds have been most often seen in this area, and two or three nests have been built here. At this time, the birds were noted perched on branches of the spruce tree in that vicinity. This tree supports the biggest of the nests which the birds have built; a nest which had in fact collapsed during the year but which has been rebuilt by the Monk Parakeets.

The two young birds are obviously smaller than the adults, being about two-thirds the size of the older birds, and show no difference in their coloration from that of the adults. These youngsters were noisily clamoring for food. One young bird would sidle over to an older bird, flapping its wings, and at times raising one wing so high that it would form a canopy over the older bird's head, all the while keeping up a continuous chatter which has already been remarked about the older birds. The adults seemed reluctant to feed the young ones, but Mr. Cleaves did observe one feeding a youngster by regurgitation,

during the half hour he watched them. The Monk Parakeets have been feeding recently on locally-grown pears and apples.

Mr. Cleaves noted that he was impressed by their communal huddling. They are very sociable amongst themselves.

This observation constitutes a record of young Monk Parakeets being born and raised on Staten Island.

Book Reviews

- Industrial Pollution Control Handbook* edited by Herbert F. Lund. McGraw-Hill Book Company, 1971. \$29.50
Environment and Man by Richard H. Wagner W. W. Norton and Company, Inc., 1971. \$7.50

These two books were prepared and published in answer to a growing need: guidance for the layman regarding the care of the environment. Each approaches the problem from a differing point of view: that of the industrialist as against that of the citizen who most often is the recipient of industrial pollution. Together the two books offer an outline of environmental pollution and its possible control as of 1971.

Professor Wagner's book supplies a wealth of information to the adult who reads at least one newspaper a day and who, therefore, has been made aware of growing concerns about air, water, and survival.

On the other hand, Mr. Lund's book approaches the problem historically and legally since industrialists are not about to be stampeded into pollution control unless there is a legal basis to force their cooperation.

The *Industrial Pollution Control Handbook* is described as a guidebook to help industry meet its obligations. The editor attempts to bridge the gap between the "best practical experts" on pollution control and "all responsible industrial managers." To achieve this, he has divided the book into three sections: (1) the evolution of industrial pollution control including chapters on history and summaries of laws governing standards for air and water; pollution control systems; control of waste from these systems; coordinated industrial-regional-municipal approaches; research in control; (2) pollution control by industry and specific industrial problems with a separate chapter on European practices; and (3) pollution control equipment and operation including systems organizations. The back matter of the book offers an excellent glossary and a competent index.

Mr. Lund examines pollution as a total systems problem, urging that interactions between air, water, and solid wastes should be evaluated by plant need as well as by the requirements of each entire industry. It must be kept in mind that repair of one offense must not be allowed to generate a secondary pollution problem.

To prepare this book the work of 36 specialists in law, industrial engineering, pollution control systems (air and water), and other related divisions contributed sections and chapters.

Although extremely detailed, this book was published at a time when previously unrecognized environmental problems had assumed panic proportions. One such problem is that of mercury wastes from manufacturing which when placed in the environment change through chemical action into methylmercury (see *Proceedings* Vol. 26: No. 1: Kriete). Omission of this dangerous pollutant does lend substance to a generally unspoken belief that industry is solely responsible for burdening the environment with the greatest bulk of incompatible materials.

Mr. Lund's somewhat querulous remark that this country has probably suffered from lack of industrial pollution control as far back as the Civil War is true, but his justification that "nobody told us about it" does not excuse the responsibility of industry. Industrial social responsibility is by no mean widespread enough to become the means by which compliance with air and water quality laws can be forced. It is much better to turn realistically to the effects on industry itself of a debased environment. Businessmen should begin to realize that their plants already suffer from the effects of pollution through increased costs because of corroded and damaged equipment; plant-days lost because of necessary shut-downs due to clogged filters and screens; and many other breakdowns, not to speak of man-hours lost through occupationally caused illnesses and debility.

At one point in the book, an industrialist's concern with the possible obsolescence of control equipment is cited as a reason for delaying the installation of such equipment. The industrialist in question prefers to wait for the "last word" in design. (This is ironic in view of the prevailing economic policy of obsolescence imposed upon the consumer for the past twenty years!)

The chapters covering pollution control by industry pollution (e.g., industrial operations which cause specific pollutants), are written by specialists in each field. This section of the book may be most revealing by its omissions. The chapter on the paper industry is one example. The absence of any discussion of mercury wastes is notable since this book is published as it is on the heels of the aforementioned concern. As we now know, mercury is one of the elements of which large amounts are discharged into the environment through operations in the paper and pulp industry as well as from a few other industries. The author of the chapter

emphasizes that sufficient equipment and systems have been developed, designed, and built which can be added to a paper mill to control its emissions of other pollutants. Yet such control is costly and yields no return. (Other industries have been able to sell by-products captured in cleaning up effluents, etc., to other industries: e.g., smelters sell lead by-products to paint industries. In this way, installation and operation costs may be amortized over a period of years. The possibility of developing secondary pollutions always exists, however.)

European industrial pollution control practices are discussed in one chapter based on information derived by American specialists who toured European industries in 1967. The working relationship between industry and government enforcement departments is more sophisticated in Europe than here. "Most countries, including Russia, in practice have pollution criteria that are more restrictive than our own.

"Prosecution of violators is rare, but compliance with best 'practical means' is followed because of diplomatic persuasion. Industry considers it in their best business and political interest to be the leader in adopting the most practical antipollution methods without government intervention." The duplication of this attitude by domestic industries may become necessary in the future through international pressure. Air and water are natural resources not limited to any specific geographical area, as we have come to realize!

Completely new systems have not been designed for use abroad; instead, new applications of existing systems have been encouraged. One such described in this chapter explains the use of the Martin gate system for refuse incineration with by-products of steam generation to run electric generators and to provide hot water for domestic space heating. This is in operation in Munich. A drawback, from point of view of this country, is the necessary use of low-grade coal in varying amounts to insure continuous heat.

In summary, this book fulfills its purpose in outline. Its chapters on legal history and its summaries of domestic legislation are very useful. The comparison of the efforts of the industries and government of this country as against those of other countries is enlightening.

Its format suggests ease of addition and revision. As a first effort in this field it is important to insure its regular revision in order to keep abreast of the need for knowledge as new problems arise. Whether McGraw-Hill will see fit to do so is doubtful in face of

the lack of enthusiasm with which both the Federal water quality standards and air quality criteria have been met by industry this past year. The retreat of the national administration from enforcement of these standards has seriously impeded improvement of the environment. At the Industry/Government Teleconference on Pollution Control held by the National Association of Manufacturers this spring, the attendance was less than that for those teleconferences held immediately prior or afterwards on labor organization and on plant safety and insurance. The public relations personnel of the NAM were admittedly surprised at the low attendance. The same personnel were not aware of the imminent publication of this handbook until this reviewer brought it to their attention.

Concern over industry's quality of cooperation is becoming evident among many groups. The Sport Fishing Institute editorialized in their September 1971 *SFI bulletin*: "In short, [Secretary of Commerce] Stans appears to be spearheading what THE NEW YORK TIMES . . . characterizes as 'an offensive' by industry against EPA's vigorous implementation of the nation's clean water and clean air laws. . . . In a massive campaign to discredit so-called 'environmental extremism' industry representatives are gaining sympathy—in the Department of Commerce, the Federal Power Commission, the Office of Management and Budget, and some business-oriented segments of Congress—for their complaint that the standards and regulations issued by the EPA are unnecessarily harsh and take insufficient account of implementation costs."

A continuous annoyance in the present edition is the abundance of typographical errors. Greater care with proofreading and correction should be applied to subsequent versions.

Concerned laymen should consult this book in order to understand what industry can do to purge itself. Those environmentalists who constitute themselves as "watchdogs" should refer to it frequently.

Dr. Wagner suggests in his foreword to *Environment and Man* that in dealing with the highly complex subject of man and his interrelationship with the environment he has had to be highly selective. This reviewer is appreciative of his organization of so much wide-ranging information and varied subject matter. This is not a text book although it certainly can be used as one, nor is it simply a handbook or guidebook for man and his environment. Its readability raises it above the category of information tool into that of a modern vademecum for the persistent environmentalist.

Its reasonable price puts it certainly within the acquisition budget of all libraries. But most important to the reader is the inferential belief that an ethic for survival exists. Part of this ethic is the understanding of the need to assure biological variety.

Most people recognize the importance of man's opposable thumb yet how many understand the importance of "snout length" to the evolution of the species? The arboreal inhabitant from which man descended is believed to have had less and less need for a long snout. Originally this snout was used to sense and distinguish between odors; its accompanying extension of jaw enabled the animal to grasp its food, once sensed, with its teeth. Man's ancestor began to use its hands with its opposable thumb to pluck food from a branch and to bring it to its mouth. Its primary need to identify food by smell and quickly to grasp it with its teeth diminished as its eyesight improved and it could distinguish food by its vision. As the length of the snout shortened, the placement of eyes changed gradually towards the frontal plane and three-dimensional vision became possible.

Man's opposable thumb gave him the advantage of using sticks and stones for protection and tools. Dr. Wagner points out that as eyes were emphasized and the nose de-emphasized, the brain responded with greater development in the portion associated with vision. The interplay between hands and eyes was of paramount importance in the further development of the brain.

Man's beginnings in the late Tertiary period were based on a primate stock with the most generalized features because such had the best evolutionary opportunities. Only one primate stock developed the basic hand-eye-brain correlation and from that stock man emerged. "The fossil record indicates that there were at least two man-like primates in Africa about two million years ago: *Paranthropus*, a heavily built vegetarian, and *Australopithecus*, somewhat smaller, more graceful, and an eater of both plants and animals." As man emerged, he alone of all animals had the ability to change the environment as a result of his hand-eye brain correlation. Maker of tools and user of tools, a being without natural means of protection and aggression, man used and still uses tools to defend himself and to kill his prey.

Each advance in man's cultural evolution has apparently had an increasing impact on his environment. Today a great many descendants of these evolutionary developments have lost contact with their natural surroundings. They are consequently unconcerned about man's continuing destruction of his environment.

Knowing only the city as environment, fear and dislike of "nature in the raw" is expressed by those to whom any part of the earth not urbanized is alien.

Both of these books reviewed here were published within a few months of each other. Dr. Wagner's book covers the problem of methymercury not included in the Industrial Handbook.

Dr. Wagner's book educates the reader in the logic of nature and encourages individual as well as communal effort in trying to undo some of the environmental despoilation. If you have time to read only one of the proliferating publications on the environment, I suggest you consider this one.

GIFTS AND BEQUESTS

The core of The Staten Island Institute, its collections and library, their care and their use, are all supported by private funds. The quality of the Institute's performance is directly determined by the nature and extent of individual gifts.

To encourage such support, The State of New York and The United States Government permit deductions on the donor's income tax returns for gifts of cash, securities, land or objects of art accepted by the Institute and its Museum.

In view of the complexities of the tax laws, the Director is happy to discuss with any donor or his advisors ways to accomplish these objectives. He is also willing to suggest specific memorials within the Institute to preserve the donor's name or to honor members of his family.

PROCEEDINGS

Staten Island Institute of Arts and Sciences



C O N T E N T S

Articles

NOTES ON SOME STATEN ISLAND WEEDS	Arthur M. Shapiro	67
BIRD COUNTS ON STATEN ISLAND 1971-1972	Mathilde P. Weingartner	71

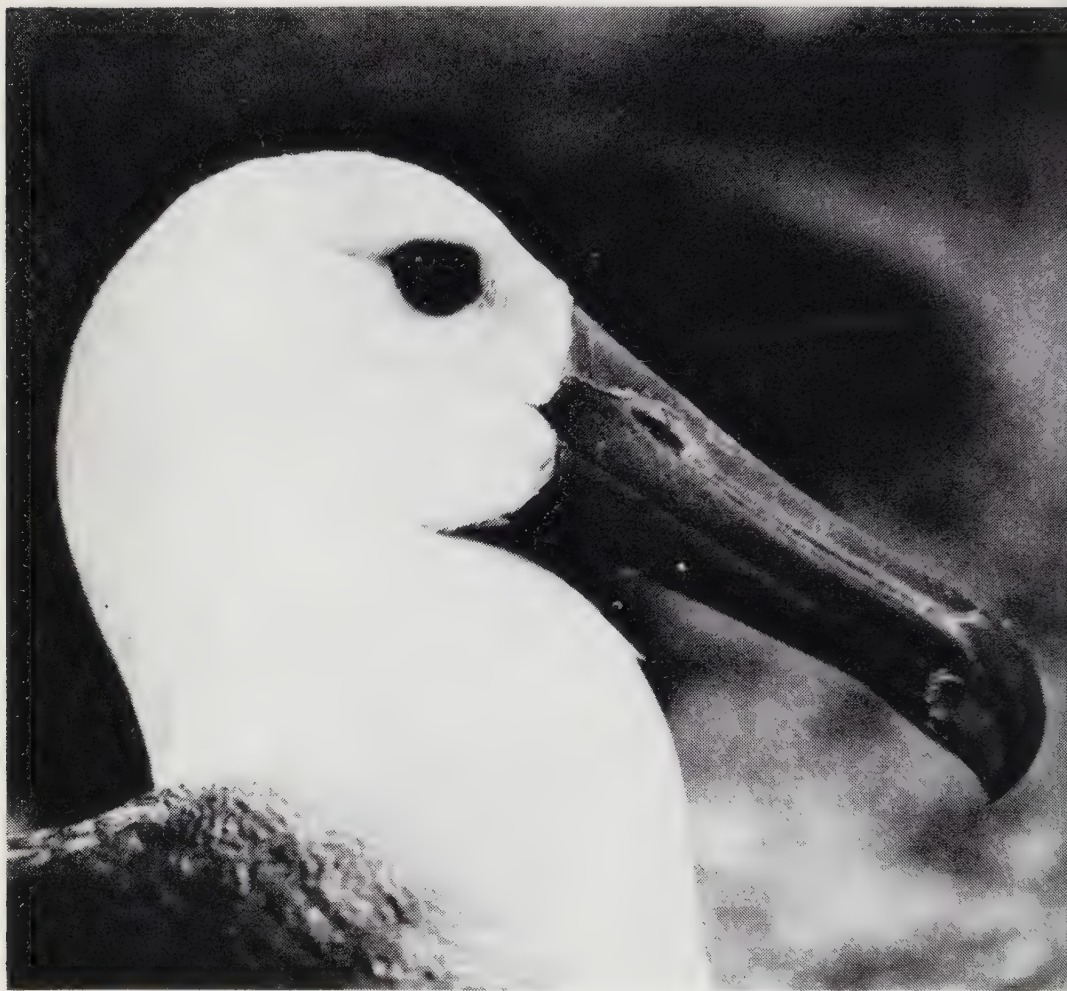
A N N U A L R E P O R T OF THE STATEN ISLAND INSTITUTE OF ARTS AND SCIENCES 1970-1971 74

<i>Book Reviews: "GALAPAGOS: Islands of Birds" by Bryan Nelson</i>	85
<i>"Birds of Europe" by Bertel Bruun</i>	87
<i>Contributors to This Issue</i>	89
<i>INDEX for Volume 26 (complete)</i>	91

Editor: G. K. Schneider

V O L U M E 2 6

N U M B E R 3



WAVED ALBATROSS

Diomedea irrorata. Hood Island, Galapagos Islands, Ecuador. July 1, 1929. Pinchot South Sea Expedition 1929. Photographed by Howard H. Cleaves. Expedition photographer. (See pages 85-87.)

Notes on Some Staten Island Weeds

by ARTHUR M. SHAPIRO

While the native flora of Staten Island is depleted by the march of the bulldozer, commerce provides a steady stream of adventive weeds to colonize the disturbed habitats. Some of these are transients, while others are undoubtedly "here to stay." Some of the more unusual weeds observed in 1970-71 are reported below. Of these, the species marked "I" were listed in the old Index of Staten Island Plants, compiled during the Depression from various published sources and herbarium sheets. In several cases the identity of the old record should be checked in light of taxonomic changes since that time. Attention to range changes of weeds in the Northeast has in general been inadequate in recent years, with largely retrospective analyses in the case of economically significant species. Highway construction and landfill operations have undoubtedly accelerated movement of weeds into new areas.

The nomenclature in this paper follows the eighth edition of "Gray's Manual."

GRAMINEAE

Setaria verticillata (L.) Beauv. Whorled Foxtail. (I)

Saint George, Stapleton, and Rosebank, by curbs and foundations, flowering August-September. Much more local and uncommon than the Giant, Green, and Yellow Foxtails.

Sorghum vulgare Pers. Broom-corn, Sorghum.

A large stand in fruit on disturbed ground near the railroad station, Oakwood, fruiting early October 1971. Presumably escaped from cultivation.

CRUCIFERAE

Cardaria draba (L.) Desv. Hoary Cress. (*Lepidium draba* of authors)

A large, thriving stand on serpentine soil under Paper Mulberry trees, Swan and Homer Streets at the foot of Ward Hill. Flowers mid-May, fruit to early July, rosettes in October.

Diplotaxis muralis (L.) DC. Sand Rocket. (I)

Several plants in flower and fruit along Granite Avenue near Walker Street, Mariner's Harbor, September-October 1970.

Eruca sativa Mill. Garden Rocket.

Abundant near the Staten Island Motor Lodge, Hylan Blvd., and a few plants in Brighton Heights and Port Richmond; presumably escaped from cultivation. Flowering August-October.

AMARANTHACEAE

Froelichia gracilis Moq. Cottonweed.

One plant growing by a curb on Castleton Ave. near Nicholas Ave., Port Richmond, August 1971.

CHENOPODIACEAE

Kochia scoparia (L.) Roth. Summer Cypress.

Abundant on the Fresh Kills landfill. Frequent, Victory Blvd. near Brook St., Tompkinsville. The usual wild form of the plant is spreading rather than compact.

Cycloloma atriplicifolium (Spreng.) Coult. Winged Pigweed. (I)

Locally very common on the beach at Great Kills; a few plants at South Beach, New Dorp, and Tottenville. Flowering August-September, and blowing as a tumbleweed in October. On November 5, 1971, dozens of large specimens were piled by the wind against the fence of the South Beach Psychiatric Facility. One dead plant found snarled in shrubs at New Dorp Beach was more than three feet across.

Chenopodium botrys L. Jerusalem-Oak. (I)

Abundant on waste ground at Port Ivory and Howland Hook, and a few plants in cinders at the Arlington Yard. This highly aromatic plant has dropped most of its leaves and turned red or purple by mid-October.

POLYGONACEAE

Polygonum orientale L. Prince's Feather. (I)

Scattered plants on the Fresh Kills landfill, on construction sites in Willowbrook, etc. Flowering July-October.

MALVACEAE

Abutilon theophrasti Medic. Velvet-Leaf. (I)

Along the route of the West Shore Expressway in embankment fill, Woodrow. Flowers and fruit, mid-October, 1971.

BORAGINACEAE

Echium vulgare L. Viper's Bugloss. (I)

A small colony in the Arlington Yard, flowering September. Rosettes were fairly common there in 1971. Usually a plant of limestone soils.

LABIATE

Agastache nepetoides (L.) Ktze. Yellow Giant Hyssop. (I)

Frequent under hackberry trees on and near Billopp Ave., Tottenville. Fruiting mid-October.

Nepeta cataria L. Catnip.

Frequent, Port Ivory and Howland Hook, flowering July-September. Usually a shale-loving plant, perhaps escaped from cultivation but growing in a very rankly weedy area far from present-day gardens.

COMPOSITAE

Bidens polylepis Blake. Tickseed-Sunflower.

Locally abundant, Fox Hills; a few near the Goethals Bridge by roadsides. Flowering August-October. This species has been abundant in southwest Philadelphia since the turn of the century but has only recently become a widespread, aggressive roadside and floodplain weed through much of New Jersey. Old Staten Island records of *B. trichosperma* should be confirmed. The taxonomy of this section of *Bidens* is confused. *B. polylepis* is frequently confused with *B. aristosa*, less often with *trichosperma*.

Helenium nudiflorum Nutt. Purple-Headed Sneezeweed.

A small colony on the grounds of the Willowbrook State School, flowering in late July. "Found in the Willowbrook area about 15 years ago by me" (M. P. Weingartner).

Silphium perfoliatum L. Cup-Plant.

Apparently well established in mucky thickets in the William T. Davis Wildlife Refuge, where it was deliberately introduced about 10 years ago, but showing no sign of spreading to similar localities elsewhere on the West Shore.

Heterotheca subaxillaris (Lam.) Britt. & Rusby. Camphorweed.

This southern plant has been established in eastern Queens for at least 10 years on beach sand. "Not in the Index, but has been common at Great Kills Park since landfill days" (M. P. Weingartner). It is not very common at Great Kills today. Seaside Blvd.

from South Beach to Miller Field, abundant; one each seen at Port Ivory, Ward Hill, and Port Richmond. August-early November, often continuing to flower even after all the leaves have withered; a major source of nectar for Checkered White (*Pieris protodice*) and Orange Sulphur (*Colias eurytheme*) butterflies at Midland Beach.

Carduus nutans L. Musk-Thistle.

Several plants in a vacant lot on St. Mark's Place near Curtis High School, St. George, flowering July-August.

Artemisia biennis Willd. Biennial Wormwood. (I)

One plant at Port Ivory, fall 1970. Much rarer around New York City than the very aromatic *A. annua*.

Artemisia caudata Michx. Tall Wormwood. (I)

Five plants on sand at Wolfe's Pond Park, flowering mid-September 1970.

Pluchea purpurascens (Sw.) DC. Salt-Marsh Fleabane.

The Index records *P. camphorata*, almost certainly in error for this species. The true *P. camphorata* occurs from coastal Delaware and Maryland southward in similar habitats; the taxonomy is confused. Abundant in salt marshes and disturbed sites near the coast. A white-flowered form observed by Goethals Road North, near the Goethals Bridge, August 1971.

Eupatorium hyssopifolium L. Narrow-Leaved Thoroughwort. (I)

Well established and seemingly aggressive on landfill at Great Kills Park and on disturbed sand at Wolfe's Pond Park. A good colony in New Dorp. Flowers September-mid October. Although this species has long occurred sporadically north to Massachusetts, it has recently become a bad weed on sandy soils near Philadelphia and is seemingly spreading northward in quantity.

Bird Counts on Staten Island 1971-1972

by MATHILDE P. WEINGARTNER

The Staten Island Christmas bird count this year was taken on the second day of the period set aside for this activity by the National Audubon Society. So this year's count was taken a bit earlier than usual; also, up to that time we had not had a hard freeze. For these reasons the species count was high and the individual count was very high, there were also more human participants than usual.

Most ponds had a very thin crust of ice, but on streams of running water there was no ice. Salt marshes were open toward the middles, although somewhat iced around the edges.

A hard freeze set in on the morning of the count and the temperature was 15° when most of the observers were in woods and fields and along the beaches. Fortunately, there was no strong wind.

The count of fresh-water ducks was higher than usual. Mallards, which used to be relatively scarce ten years ago, now can be counted in the hundreds. Black ducks were here in large numbers while lesser scaup and American widgeon are increasing.

On the landfill areas the count of hawks and gulls continues high. The mass of swirling gulls is very hard to count and only an estimate can be made. Starling also are plentiful.

Two of the observers got up long before dawn: Howard Fischer lured a screech owl from its hiding place with a live mouse. Edward Stonick prowled through the Boy Scout camp looking for owls and turned up ten more screech owls.

Some of the newcomers on the local scene seem to be on the increase. Among these can be counted the mockingbird, titmouse, house finch, and the most recent arrival, monk parakeet. A few earlier ones seem to have reached a leveling-off period: among these are cardinals and ruddy turnstones.

Probably due to the mild weather some of the birds that usually wing further south seem to be around still: one hermit thrush, 28

towhees, one veery, one palm warbler, 30 myrtle warblers, and one yellow-bellied sapsucker.

Two species which show a lesser count than in previous years are pheasants, whose nesting areas are being destroyed by new housing construction, and horned lark. The explanation is still being sought for the decrease of the latter species.

There were 25 observers: Doris Barlow, Mary and Philip Benjaminson, Esther Brewer, Vincent Cardinale, Stanley Caufield, Howard Cleaves, Robert Clermont, Gloria Deppe, Charles Fallon, Howard Fischer, Henry Flamm, Hilda Hansen, Herbert Kaltman, Kenneth Lewis, Tom Materfis, Anna Meyer, Charles Pearson, Celia Polomany, John and Edward Stonick, Esther Swayer, Elsie Van Deusen, James Wagerik, and Mathilde P. Weingartner.

<i>List of Species:</i>		Killdeer	13
Common Loon	1	Black-bellied Plover	1
Horned Grebe	116	Ruddy Turnstone	45
Pied-billed Grebe	3	Common Snipe	16
Great Cormorant	1	Greater Yellowlegs	1
Great Blue Heron	7	Purple Sandpiper	50
Black-crowned Night Heron	18	Dunlin	12
Canada Goose	40	Sanderling	45
Brant	165	Great Black-backed Gull	6747
Snow Goose	1	Herring Gull	85,560
Mallard	368	Ring-billed Gull	702
Black Duck	1160	Bonaparte's Gull	341
Gadwall	3	Mourning Dove	376
Pintail	4	Barn Owl	1
Green-winged Teal	53	Screech Owl	11
American Widgeon	16	Short-eared Owl	3
Shoveler	1	Belted Kingfisher	4
Wood Duck	1	Yellow-shafted Flicker	16
Ring-necked Duck	1	Yellow-bellied Sapsucker	1
Canvasback	16	Hairy Woodpecker	2
Greater Scaup	4459	Downy Woodpecker	49
Lesser Scaup	11	Horned Lark	5
Common Goldeneye	246	Blue Jay	339
Bufflehead	320	Common Crow	566
Old Squaw	123	Fish Crow	10
White-winged Scoter	25	Black-capped Chickadee	121
Red-breasted Merganser	9	Tufted Titmouse	34
Red-tailed Hawk	13	White-breasted Nuthatch	25
Rough-legged Hawk	19	Brown Creeper	1
Marsh Hawk	14	Mockingbird	49
Sparrow Hawk	26	Catbird	2
Ring-necked Pheasant	30	Brown Thrasher	2
American Coot	1	Robin	42

Hermit Thrush	1	Rufous-sided Towhee	28
Veery	1	Savannah Sparrow	14
Cedar Waxwing	47	Vesper Sparrow	1
Starling	18,724	Slate-colored Junco	143
Myrtle Warbler	30	Tree Sparrow	185
Palm Warbler	1	Field Sparrow	29
House Sparrow	714	White-throated Sparrow	332
Red-winged Blackbird	910	Fox Sparrow	40
Rusty Blackbird	24	Swamp Sparrow	3
Common Grackle	929	Song Sparrow	238
Brown-headed Cowbird	310	Monk Parakeet	10
Cardinal	98	<i>Total Species:</i>	92
Evening Grosbeak	137	<i>Total Individuals:</i>	125,519
Housefinch	50	(There seems to be a population ex-	
Pine Siskin	4	plosion among all the blackbirds [red-	
American Goldfinch	53	wings, grackles, cowbirds, starlings].)	

STATEN ISLAND WATERBIRD COUNT

*"With tearing eyes through steaming binoculars we
looked for ducks far too far out to sea to see."*

—JOHN KIERAN

January 16, 1972 was a very cold and windy day: the temperature ranged between 6 and 15 degrees but with a 20-mile-per-hour wind blowing, the "wind chill factor" was 21 degrees *below* zero.

All ponds were almost completely frozen with very little open water to be found, even in the salt creeks. Visibility was hampered by a haze which hung over the bay until about 10:30 a.m.

Common Loon	1	American Widgeon	9
Horned Grebe	12	Redhead	1
Great Cormorant	1	Canvasback	1
Canada Goose	1	Greater Scaup	3145
Brant	112	Common Goldeneye	102
Snow Goose	1	Bufflehead	300
Mallard	206	Oldsquaw	18
Black Duck	700	Hooded Merganser	1

This report was submitted to the New York State Department of Environmental Conservation.

Observers were: Vincent Cardinale, Charles Fallon, Howard Fischer, Anna Meyer, Edward Stonick, Mathilde P. Weingartner.

ANNUAL REPORT

of the Staten Island Institute of Arts and Sciences, 1971-1972

The Staten Island Institute quietly celebrated its ninetieth year of existence during the period of this report. The tenth decade, which lies ahead of us, may be as significant as our first decade for the Institute and its components, the Staten Island Museum, High Rock Park Conservation Center, and the William T. Davis Refuge.

In a sense, the course of our development during the next few years rests primarily upon the prospect of our move to Sailors' Snug Harbor and our participation in its preservation. On February 2, 1971 Mayor John V. Lindsay announced the City's decision to acquire six landmarked buildings and three supplementary (but important) buildings, a total of nine buildings in all on 14.47 acres. His announcement successfully concluded five years of intensive effort on the part of the Landmarks Commission and the Institute to prevent the announced destruction of all but one of these fine Greek Revival structures. This major accomplishment of the Landmarks Commission of New York City aided by the Institute is indicative of the rapid growth which the Institute has experienced in recent years.

The future plans for the Harbor's use, as developed by the Institute with the Landmarks Commission and included in the Mayor's announcement, call for the eventual occupancy of the central administrative building by the Staten Island Museum. More than twice the space currently available in our St. George location is provided by this edifice which offers a central hall plan lit from above by clerestory windows presided over by a dome three stories above the ground floor. Offices are partitioned off from the space on the main floor and dormitory facilities presently occupy the upper floors. Enclosed, many-windowed passages lead left and right from the ground floor to the adjoining buildings. The basement is a centrally defined space surrounded by rooms which are now used for library, crafts, TV-viewing, and the like. Within all

nine of the buildings acquired by the City there is a total of 156,000 square feet of space.

A suggested focus is proposed for the Institute in the study outlining possible future development plans which were prepared by Clarke and Rapuano and financed by the Parks, Recreation, and Cultural Affairs Administration of the City of New York (PRCAA), as originally agreed upon between PRCAA and the Institute. A summary of some of the recommendations provided by the Clarke and Rapuano report follows.

Recognizing that immediate steps need to be taken to find space for the expansion of programs, exhibitions, and collections of the Institute as well as its administrative offices and libraries, the consultants advise that the entire complex of nine buildings be developed as a cultural center. The Institute would serve as an administrative umbrella covering the growing programs in the arts and sciences.

The City's decision to acquire the buildings of Sailors' Snug Harbor will provide structures which can be converted for Institute usage at less cost than new construction on another site. The preservation of distinguished and nationally important landmark buildings and their use in this manner would make a significant improvement to the cultural welfare of the Island within one or two years instead of an estimated ten years required for alternative new construction.

Drawing on an earlier (1967-1968) study by Abraham Geller and Associates, the report concludes that the complex of buildings at the Harbor can handsomely serve the Museum as well as other segments of the Staten Island cultural community which are also desperately in need of space.

The scope and size of the buildings offer opportunities for cooperative programs between the Institute and the Boards of Education and Higher Education. Occupancy by the Staten Island Museum would permit the enlargement of urgently needed cultural enrichment programs for elementary, secondary, adult, and college level students.

The Clarke and Rapuano report stresses the need for substantial new private and/or federal financing. This is especially necessary if the City requests that the Institute act as landlord, and the Institute accepts full leadership for the development of the entire Harbor complex as a cultural center. The consultants predict that eventually it may be desirable to restructure the Board of Trustees, to establish a development council, and to retain professional fundraising assistance.

The precise date of the Museum's move to the Harbor is not set as yet. The trustees of Sailors' Snug Harbor will follow one of two alternatives: either to relocate their institution for the care of aged seamen in North Carolina, or to consolidate its services in a new, modern hospital to be built elsewhere on the remaining acreage of Sailors' Snug Harbor. Until they reach a decision, the Institute cannot begin to schedule moving operations.

Although no date can be suggested, the Clarke and Rapuano report outlines a general building-by-building development of the proposed cultural center activities which may include: administration offices, reception and sales, community services center, arts and history library, school of art, performing arts center, art museum, institute of urban affairs, hall of urban and national ecology, and a public auditorium.

The report attempts to define the Institute's role with respect to other institutions, both public and private, as Staten Island approaches its optimum capacity for development and population. The Institute is described as the provider of cultural, educational, and recreational programs not found elsewhere on Staten Island and therefore the diversification of programs in the arts and sciences which might become available at the Harbor is implied.

Where education has been historically weak on Staten Island—as in the fields of art and the performing arts at college and adult levels—use of Harbor facilities for special program planning would be emphasized. This recommendation is particularly suited to the Museum which for many decades provided the only adult continuing education program on the Island.

The recreational activities available through the Institute are primarily those leisurely, contemplative activities associated with nature observation and study at the Davis Refuge and High Rock, but also may include more active recreation such as hiking and horseback riding along the Olmsted Trailway traversing the serpentine escarpment of the Island. In this context, the report proposes that the City acquire the entire Harbor site of which at least forty acres would be designated for the establishment of a botanical garden. Such planning would make a major addition to Staten Island's park system and would preserve sorely-needed open space within the Island's traditionally urbanized North Shore.

The convenience of private and public transit to the Harbor location is a major advantage in siting a large cultural center there. It is easily accessible from the ferry terminal in St. George by bus and bicycle. If the North Shore route of the S. I. Rapid Transit

is restored, the supplementary service will make the Harbor's location even more central. Off-Island visitors who drive to the center will be able to reach it with relative ease especially once the West Shore Expressway is completed and the projected North Shore Drive is tied into it.

In its active participation in the preservation of Sailors' Snug Harbor, the Institute continues its tradition of providing leadership in community projects for protecting the Island's natural and man-made heritage. Since its founding in 1881, the Institute has encouraged and aided Island residents to appreciate the Island's natural beauty and its comparative richness of plant and animal life. In past years it has invited and supported efforts to expand the Borough's system of parks, to preserve its clay pit ponds and salt marshes, and to protect species of plants endangered by steady erosion of open space. As part of this sense of mission the Institute pioneered the establishment of the Staten Island Bird Sanctuary in 1933 which was the first such sanctuary in New York City. The 55 acres of the Sanctuary became the basis for the enlarged 260-acre Davis Wildlife Refuge which was opened to the public in 1955. This experience and initiative enabled the Institute in 1965 to assume administrative responsibility for High Rock Park and thus assured its permanent protection as a conservation and environmental education center. The Institute has actively supported open space advocacy including the Staten Island Greenbelt and Olmsted Trailway and has proposed special use of Ward's Point parkland for archaeological investigation before developing it for more usual park purposes. This has led inevitably to our involvement in the protection of the landmarked buildings at Sailors' Snug Harbor and their eventual adaptation and use as a cultural center.

The challenge the Institute is considering is how to create at the Harbor a cultural institution in the broadest sense, yet one fully responsive to the needs of our decaying North Shore. Exhibits, programs, courses, performances, publications, lectures at the Harbor—the full range of Institute programming—should all derive from and benefit the North Shore community in which the Harbor stands as a physical focus. At the end of the fiscal year, the Institute was informed by the National Endowment for the Humanities of their decision to offer a matching grant in answer to the Institute's application for support of *The Black Man on Staten Island* project. This project, born out of community concern and the Institute's awareness in recent years, of the needs for research-based understanding, is particularly relevant to the North Shore. First

it is necessary to secure the matching funds, however, with the assistance of Urban Corps interns, most of whom are from Richmond College, the work of the project, although slow, has never ceased.

The Davis Refuge continues to provide outings and nature walks for school children and groups of all ages. Once the renovation of the two existing buildings on the premises for use as educational laboratories is started and urban ecology research can actually be begun there (as outlined in *Proceedings v.24:2*), more efficient use could be made of the marshland, and for the first time, other parts of the acreage will be utilized. Approval and design for a viewing platform to be installed by a local contractor at the request of the Department of Parks was attained in 1971 and will be constructed subsequently during work on a planned storm sewer. This construction will curtail some of the activities at the Refuge for a while.

Unfortunately it has become increasingly necessary to be alert to planned depredations on the Refuge by private and public agencies as well. If the lab buildings were renovated sufficiently to maintain a minimum staff daily on the property protection and program would be simpler. One has only to look at High Rock to understand how on-the-spot staffing and programming maintain and develop a conservation and ecology center.

In fact this was a year of significant changes in the status of High Rock Park Conservation Center.

High Rock was accorded a "line" in the City Expense Budget under the Institute's aegis.

A fund-raising proposal was prepared and sufficient funds raised to enable the Center to employ its own director.

Through all of High Rock Park's short history, its long-range planning and development efforts were severely handicapped by the year-to-year uncertainty over continued City funding. A state of crisis occurred each spring. Its recognition in the City Expense Budget has finally given the Center a firmer financial footing and a sense of permanence. High Rock was thus established within the City cultural institutions thereby enabling the staff to devote more attention to expanding and improving programs.

Concurrently, private citizen support was developed and encouraged by "Friends of High Rock," an organization established in the fall of 1969 with a private grant and through the efforts of Mrs. Horace P. Moulton. "Friends," with the help of a grant

from the American Conservation Association, arranged through the good offices of the Community Council of Greater New York, secured the services of Charles E. Little as a fund-raising consultant to prepare the proposal to fund the salary for a director for High Rock. During the course of the year the proposal attracted sufficient private funds to permit the employment of a director for at least one year. By June 30, 1971 the New York Foundation had made a grant of \$10,000.00 which was matched by a group of other foundations.

It was at this stage that it became possible to disband the High Rock Development Committee, a sub-committee of the Group Work and Recreation Committee of the Community Council of Greater New York which had functioned under the chairmanship of Mrs. Horace P. Moulton. To continue the Development Committee's earlier work, the President of the Staten Island Institute's Board of Trustees appointed a High Rock Steering Committee under the chairmanship of Wesley E. Truesdell, to oversee the operation of the Center.

The program at High Rock continued to operate at full capacity. A summary of the programs and the number of people served follows:

Environmental Education for school groups	
(September-June)	
At High Rock Park	27,000
At the Schools	3,000
College Program (September-June)	500
Leadership Training Program (September-June)	375
Off-site Program of Workshops, Lectures	
(September-June)	1,500
Summer Program (July-August)	4,000
Scheduled Groups (non-school) (All year)	1,800
Registered visitors for Self-guided tours (All year)	5,500
Friends of High Rock "Day in May"	200
Total	43,875

Attendance remains high and the Center continues to receive more requests for group appointments than can be filled within the limitations imposed by the number of available staff members, the nature of the Center's facilities, and with proper consideration for land use. Therefore, future program plans for High Rock include expansion of off-site classroom programs and the develop-

ment of programs using other environments, both natural and man-made, with High Rock remaining the prime resource. Also, plans are being formulated that would allow a program to be developed so that there would be a continuing relationship with particular school classes.

The groundwork has been done and the future for High Rock should find the Center fulfilling its role as a leading environmental education facility able to make a significant contribution in a world expressing a deep concern for the preservation and improvement of the environment.

Annual Report of the Treasurer

1970/71

Receipts and expenditures of the Institute in the fiscal year ended June 30, 1971, are shown in the following summary:

RECEIPTS:

Interest and dividends	\$21,438.18
Dues from individual members	6,250.00
Other dues (organizations, etc.)	375.00
Museum and High Rock shops profit	8,833.34
Contributions and miscellaneous	1,233.14

TOTAL RECEIPTS \$38,129.66

EXPENDITURES:

Salaries and supplements to City-paid salaries	\$26,534.00
Other Museum operating expenses	14,255.45
Publications	3,119.19
Davis Memorial Lectures	1,143.75
Miscellaneous	1,755.20

TOTAL EXPENDITURES \$46,807.59

Additional gifts aggregating \$65,839.39 were received for specific purposes, and other funds were collected for special activities. These amounts and the expenditures therefrom are excluded from the above summary, as are gifts of objects for exhibit or other purposes.

Principal Funds increased \$23,306.28 during the year from profit on sales and exchanges of securities and from capitalizing the unappropriated surplus.

At June 30, 1971 the private funds of the Institute were represented by the following:

Securities held by the Institute:

U. S. Treasury Obligations	\$13,000.00
Other	213,734.94

Securities held by First National City Bank	273,810.14
---	------------

Cash held by Institute:

Checking Account	\$60,691.76	
Savings Accounts	26,721.58	
Petty Cash	300.00	87,713.34

Cash held by First National City Bank	997.96
---------------------------------------	--------

Museum Shop inventory	2,323.90
-----------------------	----------

High Rock Shop inventory	943.29
--------------------------	--------

Nominal value of equity in Museum Building,

Exhibitions and Fixtures	1,000.00
--------------------------	----------

Payroll Tax withholdings	(1,849.18)
--------------------------	------------

TOTAL \$591,674.39

The City supplemented the above figures with an appropriation under the 1970/1971 annual budget of \$228,020.00. This was used for the administration and maintenance of the Museum, High Rock Park Conservation Center and William T. Davis Wildlife Refuge in the following ways: Executive Management \$67,500; Curatorial and Instructional \$52,760; Expert Services \$2,000; Building Maintenance and Protection \$72,185; Office Supplies Repairs and Utilities, etc., \$34,575.

For the first time since 1955 the Staten Island Museum received capital improvement funds which were used for modernization of the electrical system in the museum building, \$48,000.00

Victor J. Morone

STATEN ISLAND INSTITUTE OF ARTS AND SCIENCES

1970-1971

OFFICERS

President Emeritus, Manuel J. Johnson
President, Terence H. Benbow
First Vice President, Thomas Schleier
Second Vice President, Bradford M. Greene
Treasurer, Victor J. Morone
Secretary, Eldridge Peterson

BOARD OF TRUSTEES

A. M. Anderson	Sasha Koulish, Ph.D.
Mrs. Charles E. Beyer	Robert M. Leng
Ira Blei, Ph.D.	John H. Lotz
Daniel L. Bridgman	George H. Maginley
Richard Buegler	Louis R. Miller
Joseph F. Burke	Mrs. Horace P. Moulton
Louis Cenci	Dr. Peter K. Nelson
Charles J. D'Arrigo	Mrs. Adolph Ostwald
Dean James L. G. FitzPatrick	Hon. Royal S. Radin
Robert P. Hagenhofer	John S. Robotham
Joseph J. Holzka	Richard M. Silverstein, M.D.
Robert L. Jacobson, D.D.S.	David C. Smith
Dr. J. Trygve Jensen	C. L. Stong
Herbert C. Johnson	Wesley E. Truesdell
Herbert S. King, M.D.	Manning W. Voorhees
Mrs. J. Joyce Klinger	Joseph A. Weissglass

EX-OFFICIO MEMBERS

Hon. John V. Lindsay
Hon. Robert T. Connor
Hon. August Heckscher
Dr. Mary E. Meade
Prof. Arleigh B. Williamson
Maurice P. Wollin

DIRECTOR

George O. Pratt, Jr.

STAFF

Staten Island Museum: Elsie P. Verkuil, Assistant to the Director; Jacqueline C. Louie, Membership Secretary; Elizabeth M. Marziale, Bookkeeper; Margaret Nichols, Secretary; Eileen Pizzuto, Telephone Operator; Receptionists (Weekends); Mary Morone, Beth Butler. Mathilde P. Weingartner, Curator of Science; Barry Leo Delaney, Curator of Art; Freda Esterly, Curator of Education; Gertrude Ferry, Educational Assistant; Gail K. Schneider, Editor/Librarian; Dorothy Kriete, Assistant Librarian. Theresa Cenci, Manager of museum shop; Shop Assistants: Geraldine Cenci, Ingrid Kjeldaas, Betsy Greene. Carmine J. Taverna, Museum Maintainer; Carl C. Scacco, Senior Museum Attendant; Museum Attendants: John Fillinger, James J. Frasca (May 1971), Charles R. Logan, Herbert Means.

High Rock Part Conservation Center: Harry F. Betros, Director of Education; Cynthia Jacobson, Field Coordinator; Ethel Z. Dicke, Program Coordinator; "Friends of High Rock": Allison Mitchell, Elizabeth Seder; Helen Hauber, Senior Clerk; Charlotte B. Clegg, Clerk. Instructors: Rudolph Lindenfeld, Olivia Hansen, Marie C. Burke, Gunda Halloran, Dorothy Aruny, Lucille Geary, Lenore Miller. Guides: Philip Benjaminson, Marion Briggan, Harold Brundage, Anne Marie Doolos, Ruth Corbett, Nina Clegg, Dorothy Fleming, Erma Gundlach, Louise Halama, Edward Hansen, Beulah Hauber, Evelyn Hare, George Johnston, Gordon Johnston, Faith Mounier, Rose Munkasey, Arthur Peters, Mary Piraino, Dorothy Quinlan, Susan Quinlan, Clayton Woolney, Anne Pieceiwicz, Irene Mahler. Shop: Jean Raymond, Manager: Nina Clegg and Susan Quinlan, Weekend Attendants. Dominic Botta, Assistant Museum Maintainer; Michael Betros, Anthony Asaro, Kenneth Lewis, Robert Taverna, Anthony Demuria, Salvatore Scacco, Norman Kriete, Everette Van Cleaf, Jr., Thomas Raia, Museum Attendants.

William T. Davis Wildlife Refuge: Mathilde P. Weingartner, Curator.

Urban Corps Student-Interns: Judith Ashman, Stuart Ashman, Clyde Ayers, Francis Brockway, Helen Byrne, Basil Coady, Kathleen Dee, Greg Dorr, James Engle, Wendy Iseman, Marjorie Kantor, Anita Kinsler, Barbara Koenig, Lilian Kraemer, Stephen Laughlin, Mariann McGovern, Deborah McGrath, Jean Martin,

Anne Meehan, Carolyn Melde, Walter Nichols, Susan Nicosia, Kathryn Orbes, John Ray, Laura Schaefer, Lili Schechter, Carmen Simon, Diane Sweeney, James Tanturri, Barry Teitelbaum, Paul Trapp, Sharon Van Willis, Pamela Vincent, Kathryn Wall, and Charles Warbington, all from Richmond College.

Also: Elizabeth Antonelli, CCNY; John Garcia, SICC; Marjorie Kirkpatrick, Vanderbilt University; Maureen McAllister, SICC; Natasha Spearman, CCNY; and John Umana, University of Michigan.

VOLUNTEERS

William T. Davis Wildlife Refuge: Mrs. Mary Benjaminson, Mrs. Oriente Calise, Mr. John Dreyer, Mrs. S. Cordano, Mrs. Anne Freeman, Mrs. Sigrid Kjeldaas, Mrs. James McDonald, Mr. Arthur Peters, Mrs. Celia Polomany, Mrs. Alice Powles, Mr. Louis Raichle, Mrs. Raymond Safford, Miss Elsie Van Deusen, Mrs. Jane Vom Saal, Mrs. Julia Von Bevern, Mr. Robert Wigand, Mrs. Anthony Ceracoli, Mrs. George Haas, Mrs. Sylvia Weinlick, Mr. Eddie Stonick.

Library: Alfons Schoenemann.

Store-front Environmental Information and Action Program (Summer 1970): Shelley Landers, John Odenthal, Lindsay Martin.

BOOK REVIEWS

"GALAPAGOS: Islands of Birds" by Bryan Nelson. William Morrow & Co., New York. \$7.95

This is the only book known to the reviewer in which the author has included a photograph of his wife in the nude. To marry a man having had the plans and ambitions entertained by the author of this book June Nelson had to be a very special girl. Soon after becoming Mrs. Nelson her husband took her off to Bass Rock, an islet in the British Isles unoccupied by humans but supporting a vast colony of sea birds called gannets. The Nelsons spent three years on the Rock while Bryan studied intensively the home life of the gannet.

Having been encouraged in his studies of sea birds by the eminent animal behaviorist Professor Niko Tinbergen, F.R.S., and others, Dr. Nelson broadened his horizon by conceiving the idea of spending a year in the Galapagos Islands on the equator, six hundred miles west of Ecuador, in the Pacific Ocean. Chosen as subjects for research were the red-footed booby on Tower Island, the most northeasterly of the islands forming the Galapagos Archipelago, and the waved albatross on Hood Island, the most southeasterly island in the group. The plan was to spend six months on each of the two islands, both desert in character. The Nelsons had with them a solar still for converting salt water from the ocean into fresh or "sweet" water for human consumption. Their best score was one gallon in a day.

A feature of the book certain to interest any housekeeper is an inventory of "Food for One Year" for man and wife, living on uninhabited desert islands. Fifty-one items are listed, probably augmented by fish and other sea food otherwise unmentioned. Samples: 12 packs icing sugar; 30 lbs. spaghetti; 21 lbs. dried beans; 100 tins corned beef (bad, thrown away on arrival); 24 tins stew, 4 tins chicken, 1 tin turkey (stolen en route); 50 tins each of spam, tuna and sardines; 100 tins butter; 14 lbs. dried eggs (ghastly mistake); 1 gal. honey; 12 jars pickles; 36 jellies; 200 tins fruit.

Bryan Nelson is a penetrating field investigator. His talents are such that the Carnegie Trust and the Frank M. Chapman Foundation, both United States institutions, provided grants without which Nelson's expedition from Britain to the far Galapagos Islands could not have been achieved. This reviewer spent a total of five weeks in the Galapagos Islands as photographer with the Pinchot South

Sea Expedition in 1929, did work on both Hood and Tower islands, and willingly concedes that could he have read a book such as Nelson's prior to visiting the islands he would have had a greater understanding of what was there.

Nelson reveals information about his bird subjects not to be found in other bird books. The reader learns that the red-footed booby lays only one egg, the only booby that does so, and that due to a lack of brood patch (bare skin which transmits body heat to the incubating egg) this booby hatches the egg by wrapping its webbed feet around it. Nelson rates the booby colony on Tower Island the largest in the world. He made a *daily* check of two hundred selected nests, reporting that the male booby may deliver as many as 2000 small items of nesting material to the female who takes them from him or helps to place them in the nest. According to Nelson the red-footed booby copulates both day and night (in total darkness), the mating "yells" carrying for miles. The single egg is incubated for 46 days, each member of the pair remaining at the nest on the average for a period of sixty hours, exceptional cases being noted in which one bird sat for six days at a spell without relief. A red-footed booby chick requires thirty-three weeks to mature, from hatching to first flight, whereas the annet of northern latitudes takes only thirteen weeks. Nelson makes the observation that boobies first select a nest site, then mate, whereas the frigate or man-o'-war bird, mates, then selects a nest site.

The author states that most sea birds keep the same partner for several years or for life, citing the waved albatross as an example. The waved albatross, so called because of wavy gray markings on the white feathers on the shoulders and breast, nests only on tiny Hood Island in the Galapagos, 600 miles west of Ecuador (to which the islands belong) on the equator. There are estimated to be no more than 3000 pairs of waved albatrosses in the world population. A precise inventory is not possible for the reason that members of the species do not breed until five years of age, and non-breeders are at sea during the nesting season.

The waved albatross is a large bird having a wing spread of eight feet; a yellow bill six inches long; and averaging eight pounds in weight. The single egg weighs almost half a pound and takes forty-one days to hatch. Dr. Nelson states that the albatross chick is fed exclusively on oil produced by the parent bird in an appendage of the stomach called the proventriculus. Young are fed by regurgitation and may receive as much as four pounds of oil at one feeding, but may go seven days unfed. Describing the scene as an albatross chick is being fed, the author writes: "The chick

swells visibly as the oil hoses into its stomach. In one bout of feeding, lasting a few minutes only, an albatross chick can take about 2000 gm of oil; over four pounds of concentrated food at a sitting. For the first four months of its life the chick is hardly more than a great, oil-filled skin, covered in matted brown down. It is grotesque, with the fascination of the truly ugly. After hitting the oil hard, its bulging stomach protrudes in a majestic curve and it waddles slowly and heavily, with its tarsi flat against the ground; it is far too heavy and unbalanced to stand on its feet." The oil on which the young albatross is fed "smells like rotten turnips" according to the author. An albatross youngster must wait until it is between 24 and 30 weeks old before making its first flight.

Author Nelson did not confine himself to albatrosses and boobies while in the Galapagos Islands. He comments on the Darwin finches, mockingbirds, man-o'-war birds; notes that there are some 300 kinds of sea weeds in the archipelago, writes about sea lions, and states that the black marine iguana is capable of feeding on marine vegetation to a depth of thirty-five feet and can remain submerged for an hour.

June and Bryan Nelson were not as isolated as might appear during their year in those distant islands. There are hundreds of permanent human residents on two or three of the larger islands; the Nelson's were visited by *Beagle II*, the vessel used by the Charles Darwin Research Station, a scientific establishment located in the islands; and while on Hood Island the Nelsons were visited by His Royal Highness the Duke of Edinburgh who later wrote the Foreword to the book.

—HOWARD H. CLEAVES

January 1972.

"Birds of Europe" by Bertel Bruun with illustrations by Arthur Singer McGraw-Hill. 1971. \$6.95 (cloth)

At first glance I was inclined to dismiss this book as a repetition of Roger Tory Peterson's book, "A Field Guide to the Birds of Britain and Europe." The two books are approximately the same size and their illustrations, maps, and text are similar. However there are sufficient differences of importance to justify listing:

1. "Birds of Europe" covers a larger area and includes the north

shore of Africa, Asia Minor, and most of European Russia. Peterson's book discusses 452 species, Bruun's covers 516 species.

2. The maps use color to show the summer and winter distribution of each species in Bruun's book. This method is, to my mind, easier to follow than Peterson's method which uses black-and-white and dotted lines to indicate distribution.

3. The maps, in addition, show major migration routes and indicate how long a season the species spends on its breeding grounds.

4. The text is similar to that of the Peterson guide but, through the use of an initial code (the key to which is *not* easily found), Bruun indicates whether a bird is a resident, summer or winter visitor, passage migrant, or vagrant.

5. The Peterson text includes names of species in English, Dutch, German, French, and Swedish, as well as the technical names, whereas Bruun lists only the English and technical names. This may be a drawback when visiting other countries where a native may know the bird only by its name in his language. If this information is missing from the book, the English-speaking visitor may have greater difficulty in identifying the bird.

6. Arthur Singer's illustrations are more like true portraits of the birds in contrast to the illustrations in Peterson's book which are diagrammatic with pointers indicating characteristic features. Mr. Singer has included small spot drawings which show habits and characteristics of the species which are very helpful. He also has prepared more flight pictures than are shown in Peterson's book.

7. Bruun and Singer present all the text on the page opposite the illustration plate. This makes the book very workable indeed. In contrast, Peterson's plate illustrations are accompanied by a brief description on the opposite page along with a page reference to a different part of the book.

"Birds of Europe" is small and fits easily into your suitcase for your next trip to Europe. If you are at all interested in birds, it will increase your enjoyment during your visit there.

—M.P.W.

ABOUT OUR CONTRIBUTORS

Arthur M. Shapiro was an Assistant Professor of Biology at Richmond College until 1972 spring term when he accepted a position at the University of California, Davis Campus. He received his B.S. from the University of Pennsylvania and his Ph.D. from Cornell University, where he worked on food-plant selection by butterflies. He has been a research assistant to the Philadelphia Academy of Natural Sciences and the Laboratory of Genetics, Oxford University, and is a frequent contributor to entomological journals. During his brief stay at Richmond College, he wrote several excellent articles which this *Proceedings* was happy to publish.

Howard H. Cleaves is one of Staten Island's best-known naturalists and ornithologists. He has worked professionally as a lecturer and film-maker on natural history subjects for Audubon Society and other organizations. He is a Life Member of the Staten Island Institute of Arts and Sciences.

Mathilde P. Weingartner is Curator of Science for the Staten Island Museum as well as Curator of the William T. Davis Wildlife Refuge. She has been the author of many articles printed in previous *Proceedings* and in other scientific publications. She is the author of *The Staten Island Walk Book*.

GIFTS AND BEQUESTS

The core of The Staten Island Institute, its collections and library, their care and their use, are all supported by private funds. The quality of the Institute's performance is directly determined by the nature and extent of individual gifts.

To encourage such support, The State of New York and The United States Government permit deductions on the donor's income tax returns for gifts of cash, securities, land or objects of art accepted by the Institute and its Museum.

In view of the complexities of the tax laws, the Director is happy to discuss with any donor or his advisors ways to accomplish these objectives. He is also willing to suggest specific memorials within the Institute to preserve the donor's name or to honor members of his family.

*Published May 1972 by The Staten Island Institute of Arts and Sciences,
75 Stuyvesant Place, Staten Island, New York 10301.*

412 

INDEX for Volume 26: Numbers 1-3 (complete). 1971

(*Italicized page numbers indicate illustration.*)

A

Abutilon theophrasti Medic. 69
Agastache nepetoides (L.) 69
 alien species as adaptors in urban environments 16-18
Amaranthaceae 68
 AAAS (American Association for the Advancement of Science) 16, 17
 American Centennial Exposition of 1876 3
 American Museum of Natural History 12, 14, 54
 American widgeon 70
Ancyloxypha numitor 48
 Annual Report 1970-1971, S.I.I.A.S. 74-84. American Conservation Association 79; art, performing arts 76; Bird Sanctuary, S. I. 77; *Black Man on S. I. project, The* 77; Board of Trustees (S.I.I.A.S.) 75, 82; City (N.Y.) Expense Budget 78; Clarke & Rapuano, study prepared by 75, 76; Community Council of Greater New York 79; cultural center activities 76; "Friends of High Rock" 78-79; Geller, Abraham, and Associates 75; Greek Revival (architecture) 74; Greenbelt, Staten Island 77; Group Work and Recreation Committee (Community Council, Greater New York) 79; High Rock Development Committee 79; High Rock Park Conservation Center 74, 76, 77, 78-80, 81; HRPCC Staff 83; High Rock Steering Committee 79; Landmarks Commission (N.Y.C.) 74; Library (S.I.I.A.S.) 84; Little, Charles E. 79; Morone, Victor J. 81; Moulton, Mrs. Horace P. 79; National Endowment for the Humanities 71; New York Foundation 79; North Shore (S.I.) 76-78; North Shore Drive 77; Officers (S.I.I.A.S.) 82; Olmsted Trailway 76; park system, Staten Island 76; Parks, Department of (N.Y.C.) 78; Parks, Rec-

reation, and Cultural Affairs Administration (N.Y.C.) or (P.R.C. A.A.) 75; Program Summary, High Rock 79; Richmond College 78; Sailors' Snug Harbor 74, 75, 76, 77; Staff, S.I.I.A.S. 83-84; Staten Island Museum 74, 75, 81; Staff, S.I.M. 83; Store-front Environmental Information and Action Program 84; Treasurer, Annual Report of (1970/71) 80-81; Truesdell, Wesley E. 79; Urban Corps interns 78, 83-84; Volunteers 84; Ward's Point (Archaeological Park) 77; West Shore Expressway 77; William T. Davis Refuge 74, 76, 77, 78, 81, 83, 84

archaeology, local 35-44

Arogos Skipper 48

Artemisia annua 70

Artemisia biennis Willd. 70

Artemisia candata Michx. 70

ARTICLES: "Philip Octavius Gravelle:" Foster 3-13; "P. O. Gravelle Photomicrograph Collection" 14; "Urban Ecology in Search of Itself" Shapiro 15-19; "Why Count Birds?" Weingartner 20-21; "Christmas Bird Count" (1970) Weingartner 22; "Natural History Records" (1961-1969) Weingartner 24-26; "Wort's Farm Excavation" (1969) Horwitz 35-44; "The European Skipper Comes to Staten Island" Shapiro 45-49; "Variation in *Aulacodiscus fugei* Barker and Meakin" Burke and Brigger 50-52; "The Monk Parakeet Invades Staten Island" Cleaves 53-57; "Notes on Some Staten Island Weeds" Shapiro 67-70; "Bird Counts on Staten Island 1971-1972" Weingartner 71-73

Atrytone arogos 48

Atrytone logan 48

Aulacodiscus fugei Barker and Meakin 50-52; 51

AUTHORS: Brigger, A. L. 50;

- Burke, J. F. 50; Cleaves, H. H. 53, 85, 89; 66 (photograph by); Foster, F. G. 3, 27; Horwitz, Jon 35; Shapiro, A. M. 15, 28, 45, 67, 89; Weingartner, M. P. 20, 22, 24, 27, 67, 89
- B**
- Bare Island (39), 41, 43 (Bare Island variant and Bare Island-Poplar Island intergrade)
- Bass Rock 85
- bay ducks, on count 22
- Beagle II* 87
- Bell Telephone Labs (New Jersey) 27
- Benjaminson, Philip (photo by) 55
- BIBLIOGRAPHY AND REFERENCE:** 44 (archaeology); 52 (diatoms)
- Bidens aristosa* 69
- Bidens polylepis* Blake 69
- Bidens trichosperma* 69
- Biennial wormwood 70
- bifacially worked tools (on Wort's Farm) 41
- bird counts: rationale for 20-21; (1970) 22; (1971-1972) 71-73
- birds, list of, annual count (1970) 22; (1971) 72-73; (1972, water birds) 73
- black ducks 71
- black marine iguana 87
- blade tools, Wort's Farm 41
- BOOK REVIEWS:** "Industrial Pollution Control Handbook" Lund, and "Environment and Man" Wagner, reviewed together 58-63; "Galapagos: Islands of Birds" Nelson 85-87; "Birds of Europe" Bruun 87-88
- Books Received 28
- Boraginaceae* 69
- Brigger, A. L. 50-52
- Broom-corn 67
- Bull, John 54
- Burke, Joseph F. 50-52
- butterflies 45 ff; 70
- C**
- Camphorweed 69
- Cardus nutans* L. 70
- cardinals 71
- Cardaria draba* (L.) 68
- Carnegie Trust 85
- catnip 69
- Chapman, Frank M., Foundation 85
- Charles Darwin Research Station 87
- Checkered White butterfly 70
- Chenopodiaceae* 68
- Chenopodium botrys* L. 68
- choppers, Wort's Farm 36, (37)
- "Christmas Bird Count 1970" by M. P. Weingartner 22
- Christmas bird count 1971 71-73
- Cleaves, Howard H. 53-57; review by 85-87; 89
- Clove Lake 22
- Colias eurytheme* 45
- "colonizing ability" 17
- Columbia University 35
- Compositae* 69
- core artifacts, Wort's Farm 36
- Cornell University 27
- Cottonweed 68
- Crane, William 54, 55
- Cruciferae* 68
- Cup-plant 69
- Cycloloma atriplicifolium* (Spreng.) 68
- D**
- Darwin finches 87
- Davis, William T., Wildlife Refuge 69 (see also Annual Report S.I.I. A.S.)
- Delaware Skipper 48
- diatom: aulacodiscus fugei Barker and Meakin 50-52
- diatoms, photomicrographs of 3, 4
- Diplotaxis muralis* (L.) 68
- Dongan Hills feeders (on bird count) 22
- Dorada linea corta* 45
- E**
- Echium vulgare* L. 69
- ecological consulting 18
- Ecological Society of America 16
- "Eco-planning" 19
- "electron" microscopes 5
- "Environment and Man" R. H. Wagner (review) 58-63
- Eruca sativa* Mill. 68
- Essex Skipper 45

Eupatorium hyssopifolium L. 70
European Cabbage Butterfly 45
"European Skipper Comes to Staten
Island" Arthur M. Shapiro 45-49;
European Skipper (*Thymelicus li-
neola*) 49

F
flake artifacts, Wort's Farm 38
Foster, F. Gordon 27; article by
3-14
Fresh Kills Meadows 21
Froelichia gracilis Moq. 68

G
"Galapagos: Islands of Birds" by
Bryan Nelson, reviewed 85-87
Garden rocket 68
"Gardener's Fern Book, The" 27
General Electric Company 10
"Gifts and Bequests" statement 63, 89
Gorenstein, Dr. Shirley 35
Gramineae 67
Gravelle "Creatacolor" Process 10
Gravelle, Philip Octavius (1877-1955),
article re: 3-14; collection, photo-
micrographs 14; reproductions of
photomicrographs on pages 7, 9,
11, 13; portrait of P. O. Gravelle 5
Great Kills feeders, on bird count 22
gulls 71

H
hammerstones, Wort's Farm 36
hawks 73
Helenium nudiflorum (Nutt.) 69
hermit thrush 71
Heterotheca subaxillaris (Lam.) 69
High Rock 19; also see Annual Re-
ports
Hoary cress 68
horned lark 73
Horwitz, Jonathan, article by 35-44
house finches 21; 71

I
ILLUSTRATIONS: P. O. Gravelle 5;
Photomicrographs: Leather-leaf Ash
7, Tabular Quartz 9, Oxalic Acid
11, P-Hydroxy and Chlorinated
Naphthalene 13; Artifacts from
Wort's Farm 1969 37, 39; Distri-

bution of European Skipper (map)
47; European Skipper (male & fe-
male) 49; Aulacodiscus fugei Barker
& Meakin 51; Nest of Monk Para-
keet 55; Waved Albatross, photo-
graphed by H. Cleaves, frontispiece
on 67
Index of Staten Island Plants 67, 70
"Industrial Pollution Control Hand-
book" edited by H. F. Lund. Re-
viewed 58-63

J
Jamaica Bay Sanctuary 21
Janssen, Hans and Zacharius 3
Jerusalem-oak 68

K
Kieran, John, quoted 73
Kochia scoparia (L.) 68
Kopetschny, Alexander E. 54

L
Labiata 69
Late Archaic 43
Least Skipper 48
Leather-leaf Ash (photomicrograph) 7
Lepidium draba 68
lesser scaup 71
Levanna (39), 42, 43
long-eared owl 22
Lund, Herbert F. (editor) 58-63

M
Madison (39), 42, 43
mallards 71
Malvaceae 69
man-o'-war birds 86-87
Metropolitan Area Archaeological Sur-
vey, Contribution #5 35-44
"Microscopists' Companion, The" 6
microscopy 3-14
mockingbird 71; 87
"Monk Parakeet Invades Staten Island,
The" by Howard H. Cleaves 53-
57; nest 55
monk parakeets 22-23; 71, 73
Moravian Cemetery 21
Mount Loretto 54
Musk-thistle 70
Myiopsitta monachus 53-57
myrtle warbler 71

N

- Narrow-leaved thoroughwort 70
 National Association of Manufacturers' Industrial/Government Teleconference on Pollution Control 61
 National Audubon Society 20, 71
 "Natural History Records 1961-1969" prepared by M. P. Weingartner 24-26
 Nela Park Works, Cleveland, Ohio 12
 Nelson, Bryan, author of "Galapagos:" 85-87
 Nelson, June 85-87
Nepeta cataria L. 69
 Newark College of Engineering 27
 New York Botanical Garden 1, 2, 14
 New York City Police Department 6
 New York Microscopical Society 14
 New York State Department of Environmental Conservation 73
 non-climax communities 16
 "Notes on Some Staten Island Weeds" by Arthur M. Shapiro 67-70

O

- observers, list of 23 (1970); 72 (1971); 73 (1972)
 oil spills, Atlantic Coast 21, 22
 Orange sulphur 45, 70
 owls, screech 71
 owls, long-eared 22
 Oxalic Acid (photomicrograph) 11

P

- "persistent disclimaxes" 16
 pheasant 71
 "Philip Octavius Gravelle: An early 20th Century Photomicrographer" by F. Gordon Foster 3-14
 photomacrogaphs, rifling markings, N.Y.C. Police Dept. 6
 photomicrographer 3-14
 photomicrographs, illustrations 5, 9, 11, 13
 P-Hydroxy & Chlorinated Naphthalene (photomicrograph) 13
Pieris protodice 70
Pieris rapae 45
Pluchea camphorata 70
Pluchea purpurascens (Sw.) 70
 Polygonaceae 68
Polygonum orientale L. 68

- Pratt Institute, Brooklyn 4
 Prince's feather 68
 projectile points (39), 41, 42, 43
 Purple-headed Sneezeweed 69

R

- red-footed booby 85-87
 Richmond College (CUNY) 27; 78, 84
 Rossville 35
 Royal Microscopical Society 14
 Royal Photography Society 14
 ruddy turnstones 71

S

- St. George ferry viaduct 22
 St. Paul's Avenue 21
 Salt-marsh fleabane 70
 Sand rocket 68
 "scanning" microscopes 5
 Schneider, G. K. 58-63
 Schwarzkolbiger Dickkopffalter 45
Setaria verticillata (L.) 67
 Shapiro, Arthur M. 27, 89; articles by, 15-19, 45-49, 67-70
Silphium perfoliatum L. 69
 Silver Lake Reservoir 22
 Sinton, John, quoted 19
 Skinner, (Alanson) 35
Sorghum vulgare Pers. 67
 Sport Fishing Institute (*SFI Bulletin*) 61
 starlings 21, 71
 Staten Island Institute of Arts and Sciences: See Annual Report 74-84; also 57, 89 (Gifts and Bequests)
 Staten Island Museum 12, 14; See also Annual Report 74-84
 stratigraphy, Wort's Farm 35
 Summer Cypress 68
 systematic ecological approach 18

T

- Tabular Quartz (photomicrograph) 9
 Tall wormwood 70
Thymelicus lineola 45-49
 Tickseed-sunflower 69
 Tinbergen, Professor Niko, F.R.S. 85
 titmouse 71
 Tower Island 85
 towhee 71

U
U. S. Fish and Wildlife Service 20
University of Massachusetts 19
University of Pennsylvania 27
"Urban Ecology in Search of Itself"
by Arthur M. Shapiro 15-19
urban species 17

V
"Variation in *Aulacodiscus fugei*
Barker and Meakin" by Joseph F.
Burke and A. L. Brigger 50-52,
51
Velvet leaf 69
Viper's bugloss 69

W
Wagner, Richard H. 58-63
waterbird count 73
Wave Hill 19
waved albatross 66; 85-86

Weingartner, Mathilde P. 27, 67, 69,
89; articles by: 20-21, 22-23, 24-
26, 71-73, 87-88
whorled foxtail 67
"Why Count Birds?" by M. P. Wein-
gartner 20-21
William T. Davis Wildlife Refuge
27; also see Annual Report
S.I.I.A.S. 74-84
Winged pigweed 68
Wolfe's Pond Park 70
Woodland Indians 43
Woods Hole, Massachusetts 12
Woodward, John J. (Brigadier-Gen-
eral, 1876) 3
"Wort's Farm Excavation 1969" by
Jonathan Horwitz 35-44

Y
yellow-bellied sapsucker 71
yellow giant hyssop 69

NEW YORK CITY'S *LAST Frontier*

Field Trips on
Staten Island

Arthur M. Shapiro

59

69

72

78

81

83

86

The Staten Island Institute
of Arts and Sciences : 1972

75

76

77

Introduction, Fronts & Progress by Henry A. Schroeder, M.D.

DEX: Volume 27, Number 3

90

Editor: G. K. Schneider

VOLUME 27

NUMBER 3

*NEW YORK CITY'S
LAST FRONTIER*



NEW YORK CITY'S

CONTENTS:

Foreword

Introduction by Herbert Schueler

Introduction by Terence Benbow

I	Of Bloomfield & Bogs	
II	The Pine Barrens	1
III	Acid & Salt	1
IV	The Cliff at Homer Street	2
V	South Beach	2
VI	Some Days Afield	3
	Afterword	5
	FIELD LIST	5

LAST *Frontier*

Field Trips on
Staten Island

WRITTEN AND ILLUSTRATED BY
ARTHUR M. SHAPIRO

Staten Island Institute of Arts and Sciences

INTRODUCTION

Professor Arthur Shapiro managed, during his all-too-brief tenure on the Richmond College faculty, to explore and study the ecology of Staten Island not only with the observant eye and analytic mind of a brilliant scientist, but with the appreciation of a true lover of nature. No one using this remarkable little book as source and guide, who follows the paths through the still many undespoiled plains, fields, forests, and bogs of the Island, can fail to have his insights sharpened and his appreciation and enjoyment heightened. But throughout this volume, sometimes expressed, sometimes implied, is a note of sadness. Its very title is ominous: *New York City's Last Frontier*. Underlying all is the fear that man's determination to build will destroy; but there is the hope as well that perhaps here in Staten Island, for the first significant time in the history of the development of cities, a determined effort will be made to build and preserve at the same time. As Professor George Small, also a member of the Richmond College faculty, has said in his book, *The Blue Whale*: "How long will man persist in his belief that he is master of this Earth rather than one of its guests?" Let us all hope, therefore, that in many years to come this little book will continue to have current value, and that the natural beauties it describes will not have descended into dimly remembered history.

Herbert Schueler
President
Richmond College

INTRODUCTION

Dr. Shapiro's concise book has given the Staten Island Institute of Arts and Sciences another opportunity to act on behalf of preservation of the kind of environment which—in the first place—attracts and holds people to Staten Island.

Since its inception in 1881, the Institute and its faithful members, staff, and friends have always been concerned with the continuation of the great variety of Island natural resources. The Island at one time benefited by a wide scope of environments from seashore, estuary, and bay to fresh-water stream, to rolling and hilly landscapes, as well as wide sweep of plains. Some of these environments are left to us today, and should be preserved as Frederick Law Olmsted urged in 1870 when he wrote:

"Nowhere on Staten Island is there a landscape or even a glimpse of agreeable scenery which belongs permanently to the public—which no man has the right to obstruct and destroy in pursuance of private and selfish ends."

The parks which have since been developed were in great measure an answer to his demand. But there is still much more which should be saved for posterity, for study, and for appreciation as Dr. Shapiro suggests in this book. Yet some of the areas described herein are already threatened with total obliteration. As of this writing, those of most immediate concern are on the west shore and include the bogs and the pine arrens. We invite you to take this book, take a field trip, and help the Institute, Richmond College, and others to save some of Staten Island's last-remaining wild beauty.

Terence H. Benbow

President

The Staten Island Institute of Arts and Sciences

I. OF BLOOMFIELD & BOG

The West Shore of Staten Island, along South Avenue from Forest to Travis Avenues, will probably become New York City's last big industrial park. If you look at this area on Hagstrom's street map of Richmond, you will find a variety of streets which do not exist as well as the neighborhood designation, "Bloomfield." Very few Staten Islanders seem to know the name, and I do not know its history, but its future as a neighborhood is not very promising. At present this is mostly in City hands and has been protected from development. While the forces of finance and politics have moved inexorably toward committing the land to industry there has grown up on it an extraordinary complex of adjacent soil lowland communities including the only growing plant bogs in New York City.

A bog is a very special place, hostile to most conventional forms of life. Bogs form in poorly drained sites, where water collects and stagnates. As organic matter falls into the water it is attacked by decay organisms, which decompose it by oxidation—using oxygen they remove from the water. This depletes the dissolved oxygen, which is not replaced because the water neither flows nor is stirred. But there is more to a bog than oxygen depletion; there is acidity. Place a piece of litmus indicator paper in bog water and watch it turn shockingly pink. The low pH (hydrogen ion concentration) of bog water inhibits the decay organisms further, so that organic matter accumulates faster than it can be decomposed; and the bog fills up with it. We call such accumulated, undecomposed



Bur-reed (*Sparganium
eurycarpum*) of the
Bloomfield bogs

The bog at South Avenue from the
service road of the Expressway

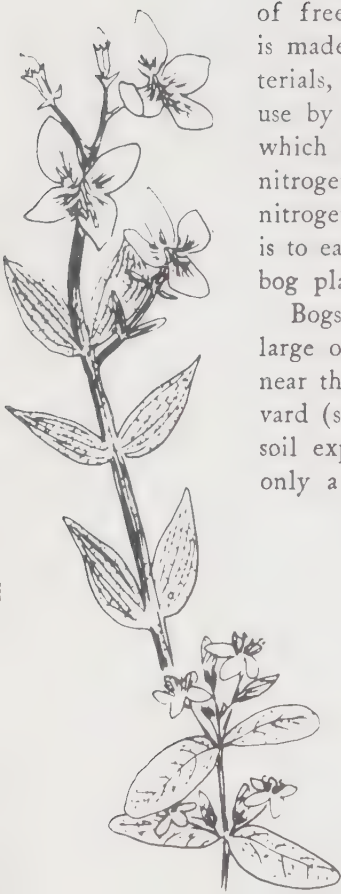


material "peat," and under certain circumstances it may pile up to great depths such that the heat and pressure exerted on the lowest strata transform them to coal.

Why are bogs acid? There are several contributing factors. One is that they tend to form in areas where soils are already acid, for reasons we will discuss in the next chapter. Another is the abundance of organic acids, such as tannic acid, released by plant materials into the water. A third is the presence of peat moss, or sphagnum, a plant which actually extracts basic ions from water and thus acidifies the environment around it. (You take advantage of this property when you place dried peat moss as a mulch around azaleas, rhododendrons, and conifers in your garden; all these plants require acid soils for best growth.)

The inhibition of decay means that there is a shortage of free nitrogen in bog soils. Now here is a paradox: peat is made of dead plants, which are made of nitrogenous materials, but without decay all that nitrogen is unavailable for use by living plants and might as well not be there! Plants which can grow in bogs, then, must either be tolerant of a nitrogen-deficient environment or have alternate sources of nitrogen. The alternative to getting nitrogen from the soil is to eat it, as we do. All our American carnivorous plants are bog plants.

Bogs were once common on Staten Island. There was a large one in Grasmere, near Fingerboard Road, and another near the intersection of today's Expressway and Hylan Boulevard (still recognizable by a trace of bog shrubbery and peat soil exposed just northwest of the overpass). Now there are only a handful left, and the best of them are all on the



Showy bog flowers:
 meadow-beauty (*Rhexia*
virginica) above, St.-
 John's-wort (*Hypericum*
virginicum) below

West Shore. All have been seriously disturbed, and many of the bog plants which once grew in them are gone. Only a few decades ago there were three or four different carnivorous (insectivorous) plants on Staten Island: the pitcher plant (*Sarracenia purpurea*), two species of sundews (*Drosera*), and a bladderwort (*Utricularia*). Now only the bladderwort is left, but it is very abundant in all of the bogs where the water is four inches or more deep. This filmy plant bears tiny cups, or bladders, in which small swimming organisms are trapped and eaten. The other species could be reintroduced with almost certain success. So, too, could cranberry, the juicy prize of they who brave the bogs in midwinter when the frost has produced just the right taste. Cranberries grow on tough, wiry vines with evergreen leathery leaves that seem much too small for the berries, and they grow only on peaty soils. They were common enough here in William T. Davis' boyhood.

The "best" bogs are opposite each other on either side of South Avenue about midway between Lambert's Lane and Travis Avenue. The one on the west side is almost completely screened from view by a roadside bank of tall reed (*Phragmites*)—a plant which will grow around the edges of bogs, but not in the acid water itself. Although these two bogs were formerly no doubt one, they differ vegetationally in a number of ways today. The one on the east side has all of the bur-reed (*Sparganium*), an odd aquatic plant with iris-like leaves and spiny ball-like fruits. It also has most of the buttonbush (*Cephalanthus occidentalis*), with its globular clusters of fuzzy white flowers in midsummer. The one on the west has a great deal of growing peat moss and bog St.-John's-wort (*Hypericum*), which unlike our weedy St.-John's-wort has purple-pink flowers.

Bunchtop bluestem (*Andropogon glomeratus*) of the Bloomfield bogs



Further south on the east side of South Avenue is a small bog, nearly dry now and full of garbage, but still recognizable by its tussock sedges (*Carex stricta*) and the stiff branching of the sour gums (*Nyssa sylvatica*) around its periphery.

Perhaps the "most interesting" bog is the one at the south east corner of South Avenue and the south service road of the Expressway. A stream formerly snaked through lowland pine oak forest here. When the Expressway was built the stream was dammed, flooding this lowland. So great is the tendency to bog development on the acid soils of the West Shore that in just a few years this inundated forest has become strongly boggy. It is especially noteworthy for its variety of bog sedges (Sedges are related to grasses and are frequently lumped with them. Many sedges can be recognized by their triangular stems in cross-section, hence the mnemonic jingle, "Sedges have edges . . .") On slightly higher, drier ground along South Avenue tall reed has taken over forming a large, solid stand.

The bogs are breeding sites for spring peepers, the tiny frogs whose mating chorus fills March and April evenings along South Avenue. They have, too, a surprising array of special butterflies, most of them feeding in the larval stage on sedges. They came here in the wake of the continental glaciers 15,000 years ago and when the bogs have gone they will go too, never to come again.



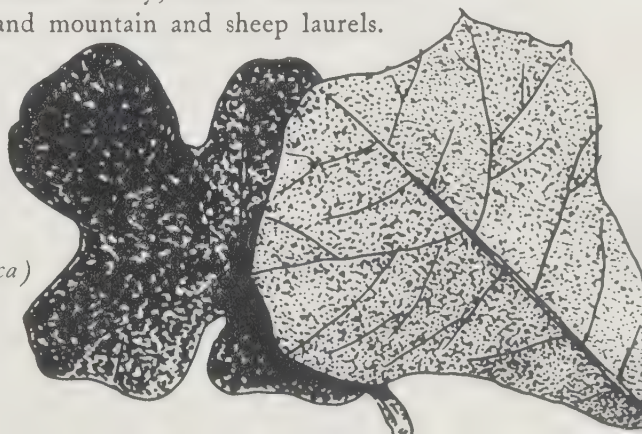
Spring azure
(*Lycaenopsis argiolus*)
on foamflower (*Tiarella
cordifolia*)

II. THE PINE BARRENS

A million acres of Burlington and Ocean Counties, New Jersey, is a wilderness known as the Pine Barrens—a strange land of bogs and dwarf trees and tiny ferns and orchids and frogs and grasshoppers found hardly anywhere else on earth. William T. Davis, Staten Island's great naturalist of the first half of this century, knew the Pine Barrens as well as anyone—he, in fact, discovered the abundance of the endemic Pine Barrens tree frog, *Hyla andersoni*. No doubt he knew Staten Island's own "pine barrens" intimately, but he never thought of them as a disappearing resource. Now they are nearly gone, and with their last remnants the most unusual of the Island's plants will disappear.

Most of the mid-Atlantic region would become some sort of oak forest if left to its own devices. Although they contain many oaks, pine barrens areas tend to remain in pine—usually pitch pine, *Pinus rigida*. The reason for this is fire—which, in turn, is dependent on the nature of the soil. Pine barrens develop on acid sand. Sands are soils with large particle sizes; water runs down through them rapidly until it reaches an impermeable layer. This does more than to leave the upper reaches of the soil dry most of the time. As the water runs down it carries away soluble components of the soil, including calcium carbonates and such plant nutrients as soluble nitrates and phosphates; the result is an acid, impoverished topsoil unsuitable to the growth of many plants. Only a few kinds of plants thrive in such situations; notable among them are some oaks, pitch pine, and the heath family, which includes the blueberries, huckleberries, and mountain and sheep laurels.

Two pine-barrens' oaks:
post (*Quercus stellata*)
and blackjack (*Q. marilandica*)



As these plants grow, they accumulate dead leaves as litter on the soil surface. Normally, such litter is decomposed by bacteria and fungi and returned to the soil for re-use. But the surface of the sand is too dry for many decomposers. Moreover, the chemistry of the litter is itself hostile to them. Many pine barrens plants manufacture large quantities of tannic acid in their leaves. Why do we tan leather? The tannic acid acts as a preservative, combining with protein to render it unusable to decay organisms. (It is also unusable to leaf-feeding insects, with a few notable exceptions. We will return to this point later in this book.) The oak leaves and pine needles pile up, then, until lightning or careless man starts a fire which consumes them.

How much else the fire consumes depends on how dry the weather has been, how much litter is on the ground, and what the wind does. But all of the pine barrens burns, however irregularly. And here lies the secret of the pines: while most oaks are killed or seriously set back by fire, the pines bounce back quickly and actually benefit from occasional burning.

Acid sand and fire come together in various places on Staten Island, but nowhere more dramatically than in Woodrow. Find Winant Avenue, a little street—barely passable—going from Woodrow Road to the West Shore Expressway route. The soils here are very deep yellow sands, as acid as any in New York State. On the south side of Winant pay close attention to the roadside oaks. They are blackjack oak (*Quercus marilandica*), a species virtually unknown in New York City today but characteristic of the New Jersey Pine Barrens. It is the most fire-resistant oak, and its strange, three-



The gypsy moth (*Porthetria dispar*): male above, female below

A bridle path in the pine barrens near Woodrow Road



lobed leaves are unmistakable. Walk back through the grove of oaks, taking care to notice the four or five post oaks (*Quercus stellata*) with their cross-shaped leaves, and the small American chestnuts (*Castanea dentata*), one of which bore fruit in 1971. American chestnut was virtually wiped out by fungus blight accidentally introduced from Asia around the turn of the century. It is said the disease came in on Chinese chestnuts planted in Central Park, yet here within the boundaries of New York City the tree continues to grow. These poor stump sprouts are a far cry from the stately giants of yesteryear, however.

Beyond the trees is a jungle of briar (*Smilax*) covering the scars of innumerable burns. A walk along the bridled paths may leave your legs scratched, but you will be rewarded by a peek at the vegetation that can withstand the twin extremes of terrible soil and frequent fire. Here and there you will find a relict pine left over from the days when this truly was a Pine Barrens. Behind a house facing on Woodrow Road is a colony of little buttonweed (*Diodia teres*), a commonplace sixty miles farther south, but a rarity indeed in these precincts.

Parts of South Avenue in Bloomfield have a somewhat similar vegetation. Here the water table is much closer to the surface. Woodrow sits on a slight promontory, but Bloomfield is at sea level, and the increased soil moisture has allowed much of it to develop into a swamp forest of pin oak (*Quercus palustris*). Here and there one can find drier spots with pine barrens plants. The best stands are at the corner of South and Merrill, particularly the southeast side. On this gray sand, under a stand of mixed oaks (no black-



Cat briar or greenbriar (*Smilax*), the scourge of Staten Island hikers but a good revegetator of burned areas

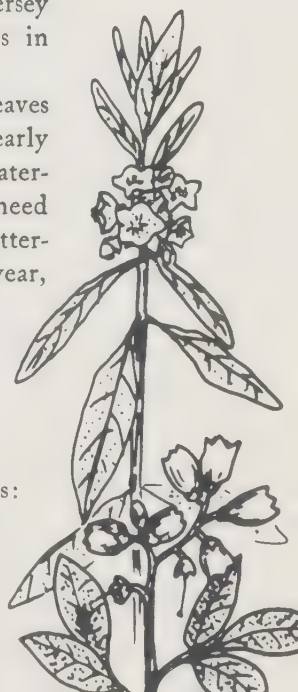
but some post), is a large colony of the evergreen laurel (*Kalmia angustifolia*) mixed with bracken fern (*Pteris aquilina*). Note the enormous hills made by the mounds of the mound-builder ant; this species gathers and stores seed, some of which germinates to provide a light covering to the raised mound. Directly across the street, where the soil has been disturbed, are a few scrub, or bear oak (*Quercus ilicifolia*), another characteristic plant of the Pine Barrens.

There were once many more Pine Barrens species on the Jersey Shore. Most of the real rarities were gone even before William T. Davis's death in 1945. One, the southern swamp pink (*Helonias bullata*), had reached its northernmost range here. It was last seen in 1882. At least one plant, the rose-leaved violet (*Viola primulifolia*), still can be found in a pocket of sandy soil along Hylan Boulevard just above Seaside Park.

Even before the West Shore is developed, the survival of native plant areas is imperiled by the menace of the gypsy moth (*Porthetria dispar*). This European pest has been in America about a century, but only recently has it expanded its range to the New York metropolitan area and the New Jersey coastal plain. It is a major defoliator, and it specializes in eating oak forests developed on poor soils.

As we noted above, the tannins deposited in oak leaves make them generally unpalatable to insects. Only in early spring, before the tannins have been synthesized, can caterpillars eat quantities of oak and obtain the protein they need for survival and development. Thus most oak-feeding butterflies and moths have only one brood very early in the year,

Two acid-sand heaths:
sheep laurel (*Kalmia
angustifolia*) above,
highbush blueberry
(*Vaccinium*) below



the adults flying about the time the buds open and the larvae feeding on the young, expanding leaves; or else the adults fly in summer but deposit eggs which overwinter and hatch into larvae around the time of bud burst. The whole phenology of the community is geared to the chemistry of the oak leaves! In midsummer only a very few insects have the biochemical apparatus to cope with tannin successfully. One of these is the ribbed-cocoon-maker, a tiny moth whose larvae skeletonizes leaves of red, black, and pin oaks late in the season. Its cocoons, spindle-shaped with parallel ribs, are only a few millimeters long and are spun on any surface within a few feet of the ground; they are often immensely abundant. Until a couple of years ago they held a monopoly on summer oak, but no more. A careful survey in 1971 revealed unexpectedly large gypsy moth populations on the West Shore and on Todt Hill, and we can expect large-scale defoliation within at most a few years. Although the oaks are capable of refoliating (producing the strange effect of spring's light green in mid-July), such destruction cannot help but affect the composition and stability of the entire community. Think about it.



A burned-and-regenerated pitch pine (*Pinus rigida*) of the sort nearly extinct in Woodrow

II. ACID & SALT

Lilac Court is a dead-end street off Forest Avenue a few blocks east of the Goethals Bridge. Between it and the Expressway service road stretches a complex of environments notable for acid soil and salt marsh endemics and for the best blueberry picking—and the worst mosquitoes—in New York City.

I have given more blood to the salt-marsh mosquitoes—"Jersey devils"—in the brush off Lilac Court than I have to the Red Cross. I have no idea whether fresh blueberries help make "good, red blood," but I like to think that they do, and that I am coming out ahead on the transaction. If the figures in the psychic income generated by seeing some of the area's ecological specialties, the trip is always worth the price.

The Lilac Court area is on gray sand similar to that along South Avenue, and similarly acid. From Forest Avenue south the land slopes ever so gently upward and dries out, then dips down again into salt marsh at the Expressway. A brackish creek has been culverted under the roadway, bringing the special salt-tolerant community directly up against the acid currens, swamp forest, and even a bit of bog. Here, if one is lucky, one can see woodcock, belted kingfisher, snowy plover, and great blue heron, all of which showed up in 1971.

Between Lilac Court and Morrow Street the swamp forest changes to brush. Where Morrow Street takes a 90° turn one can continue back on a dirt path—all too often blocked by dumped refuse!—toward the Expressway. At either side grows the bunchtop bluestem grass (*Andropogon glomeratus*),

Saltwort (*Salicornia*),
common in the West Shore
salt marshes in late
summer



characteristic of damp acid sands in the Pine Barrens and elsewhere. Many bog grasses have their inflorescences aggregated at the top of the stalk, rather than attenuated along it like their dry-land relatives. This is probably an adaptation to preserve the seed from seasonal flooding. The dry, dull red culms of *Andropogon* are extremely decorative in late autumn and very useful in arrangements; they should be taken after the tiny winged seeds have been dispersed by the wind.

All around are tall shrubs. Most of these are highbush blueberries of at least two species, but mixed with them are chokeberries (*Aronia melanocarpa*), a relative of the apples and a staple for the birds. In July the striped hairstreak butterfly (*Satyrium liparops*), whose larva feeds on chokeberry leaves and buds, can be found here in large numbers. The females sit inside the bushes, while the pugnacious males sit at the tops and defend a large aerial territory around their perches. Both chokeberry and blueberry require acid soils. You will see both in abundance all along South Avenue in Bloomfield and at the bogs.

There is "action" underfoot as well. The path is carpeted with the lance-leaved violet (*Viola lanceolata*). In May this denizen of peaty soils produces tiny white, purple-veined flowers which are eagerly sought by the first bumblebees of spring. Like other violets, it continues reproducing long after the spring flowers have disappeared; through midsummer myriads of inconspicuous flowers are produced which fertilize themselves in the bud and never open, but instead go right to seed. These are called "cleistogamous flowers" by botanists. Although self-fertilized seed is less vigorous than cross-ferti-



Elfin (*Incisalia irus*)
on lance-leaved violet
(*Viola lanceolata*)—
both found on the acid
West Shore

Salt marsh behind Lilac Court
and Morrow Street

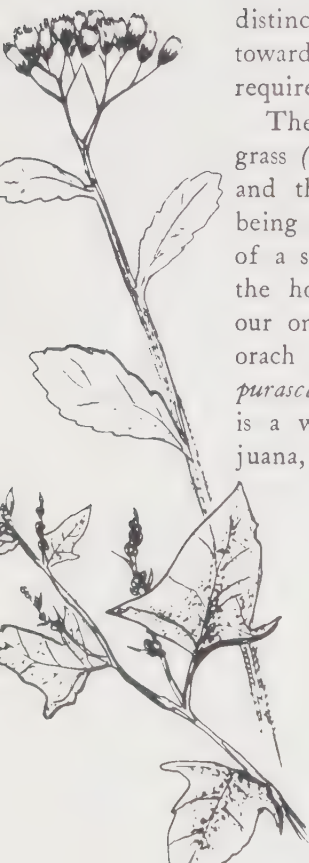


lized, such a system provides a "backup" in case for some reason the first seed crop is lost.

Mixed with the violets are thousands of tiny cinnamon fern plants only a few millimeters tall; only a very few of them will survive to become the large, stout plant we see so often in damp sites around the Island, and whose early spring fronds—or rather their uncoiled "fiddleheads"—are such a delicacy to those wise in culinary woodcraft.

The transition from peaty, acid soil to salt marsh is marked by a band of tall reed, a plant which hugs the edges of environmental extremes but seldom partakes of them. Salt marshes are poor oxygenated, too, and accumulate peat which is acid below its surface. The abundance of salts creates osmotic problems, however, that bog plants cannot solve. Here the distinctive salt-peat flora makes its appearance. Salt marsh vegetation is clearly zonal—its composition varies in distinct, predictable bands as the salt concentrations decrease toward the landward side and less and less salt tolerance is required for survival.

The immediate edge of the salt creek is bordered by cord grass (*Spartina*), the most salt-resistant of our common plants and the basic component of the Fresh Kills marshes now being consumed by landfill. Behind the cordgrass is a meadow of a soft, low grass called alkali grass (*Distichlis spicata*)—the host for the salt-marsh skipper (*Panoquina panoquin*), our only salt marsh butterfly. Mixed in with this grass are orach (*Atriplex hastata*), salt marsh fleabane (*Pluchea purpurascens*), and water hemp (*Acnida cannabina*). The last is a weed with an uncanny resemblance to growing marijuana, especially at a distance. True marijuana has been



Two common salt-marsh plants: fleabane (*Pluchea purpurascens*) and orach (*Atriplex hastata*)

found in vacant lots on the Island more than once recently; it may have been planted, and at any rate grows only on dry, rich soils. Be sure to smell the foliage of salt-marsh leabane!

There are also two shrubby plants in the salt marsh. High-ridge bush (*Iva frutescens*) is, as its name suggests, a sensitive salt indicator. Groundsel-tree (*Baccharis halimifolia*) is even less tolerant of salt, and grows at the margins of the meadows. Both seem to prefer just a hint of salt in their environment, but groundsel-tree is sometimes seen in completely salt-free situations, as along Victory Boulevard in Travis. These two plants have the distinction of being our only woody members of the Composite family, which includes the gold-rods, asters, thorough-worts, and wormwoods.

Most salt marsh plants show obvious morphological adaptations to life in an osmotically difficult environment. Since the tendency is to lose water to the hypertonic surroundings, their main problem is to conserve water by limiting loss by evaporation and by decreasing the surface-to-volume ratio of the aerial parts for storage. Most of them have thick, fleshy leaves and a waxy cuticle which helps hold in moisture—adaptations familiar in desert plants.

White sweet-clover
(*Melilotus alba*) and two
hairstreak butterflies—
visitors on the West Shore



IV. THE CLIFF AT HOMER STREET

Mention Staten Island to a geologist and he is likely to say "serpentine." Serpentine rock is the backbone of the Island forming the core of the hills. Although there are a few minor outcrops elsewhere in the metropolitan area, in this region of great geologic complexity, serpentine is very much a Richmond specialty.

The origin of serpentine is a matter for debate. It is a very peculiar rock, composed almost exclusively of magnesium and iron minerals. And it is chemically very active. Fresh serpentine from below the surface is heavy and black, but it quickly weathers to the familiar gray-green color and light, crumbly texture. The actual minerals produced by the weathering vary according to the composition of the particular outcrop and the nature of the weathering agent, and therein lies the fascination for those who hunt the rarer and more beautiful products of serpentine's decay.

The most important component of serpentine is a hydrated magnesium silicate. When exposed to acids, this breaks down quickly; one of the most effective weathering agents is the sulfuric acid in our Staten Island rainfall, produced by smokestack emissions of sulfur oxides. When sulfuric acid attacks serpentine one of the results is magnesium sulfate, familiarly known as Epsom salts. Todt Hill, then, is (thanks to air pollution) turning inexorably into a mountain of Epsom salts!

Under certain circumstances serpentine develops a folded



Giant foxtail (*Setaria faberii*)—one of our commonest, and showiest, weedy annual grasses

rous structure, usually associated with a rosy color. We call the result an anthophyllite schist, and if the process continues further the mineral chrysotile, with a finely fibrous structure, comes to predominate and you have commercial "asbestos." Asbestos was mined on Staten Island late in the nineteenth century. The most famous vein, and one which with a little effort will still provide passable hand specimens, is located on the east side of Ward Hill, on the bare rock cliff that looks out over the harbor from Swan and Homer Streets.

Serpentine has a very limited geographical distribution which seldom coincides with the locations of cities. The Homer Street cliff and other exposures in Tompkinsville (on Victory Boulevard opposite Brook Street) provide unique information on the vegetation that will grow on serpentine under city conditions; for serpentine soils always support a peculiar flora.

Magnesium is essential for plant nutrition, but serpentine-derived soils provide too much of a good thing—and not enough of others, such as nitrates, phosphates, and calcium. The soils are sandy and so combine surface drought with these other unfavorable characteristics. In general, the vegetation developed on them is a "serpentine barrens" composed of dwarfed and stunted plants of species not restricted to these soils, plus a considerable percentage of edaphic (soil)emics—plants found *only* on serpentine. The latter group is of great interest because they occur only in well-defined colonies on outcrops of serpentine, often hundreds of miles apart. Experiments have shown that most serpentine endemics do not really require the chemistry of ferromagnesian soils; they could grow perfectly well on normal soils but are competitively excluded from them by other plants. Only on ser-

Bush clover (*Lespedeza capitata*), an important constituent of sandy and serpentine soil vegetation



pentine, where the other plants cannot grow, are these species able to come into their own.

Between Philadelphia and West Chester, Pennsylvania, are fine examples of serpentine barrens. Although many of the endemic species formerly occurred on Staten Island, especially on Todt Hill, we never had really typical serpentine vegetation because the Pleistocene glaciers covered the area with rock debris, or moraine. Much of this was granitic in nature and helped to enrich the soils with plant nutrients lacking in pure serpentine. The Philadelphia area, of course, was never glaciated.

At Homer Street the bare face of serpentine was exposed by blasting and little soil enrichment can have taken place. Near the top of the cliff is a band of reddish, tall bunchgrass. This is little bluestem (*Andropogon scoparius*), and it is almost always a dominant plant on serpentine though it will also grow on other acid sands. Another serpentine associate hereabouts is the little gray goldenrod (*Solidago nemoralis*), with gray-green downy foliage and large, showy flowers. If you look very carefully you may find the white goldenrod or silverrod (*Solidago bicolor*); in 1971 I saw only two individuals of it on the cliff.

The Japanese knotweed (*Polygonum cuspidatum*), a huge, stout, bushy plant with stems jointed like bamboo, is proving all too well suited to growing on serpentine, as is the Japanese honeysuckle (*Lonicera japonica*). Both of these introduced weeds are common at the lower end of the cliff. Across the road, at the corner of Swan and Homer, is a grove of paper mulberries (*Broussonetia papyrifera*), a nicely-shaped tree with variably-shaped leaves covered with a fine down. Introduced from the Orient, this tree seems at its best



Bluestem (*Andropogon scoparius*), the dominant grass of serpentine soils

serpentine and is seldom seen elsewhere. The ground below the mulberries is covered with grass and a somewhat fleshy, grayish plant which bears clusters of tiny white flowers in May. Examine them carefully. They have four petals and six stamens, the hallmark of the mustard family (*Cruciferae*)—a family to which many garden vegetables (cabbage, cauliflower, collards, radish, horseradish) and weeds (mustard, shepherd's purse, peppergrass) belong. But this is not a mustard familiar to most people. It is hoary cress (*Cardaria hirsuta*), a European plant now a troublesome weed in the west but rare in the east; this colony and one in Astoria, Oregon are the only known occurrences in the metropolitan area.

It seems, then, that even on serpentine, in urban vacant-lot situations the native plants must sit back and take second billing behind the introduced weeds!



Seaside goldenrod (*Solidago sempervirens*), abundant all over the Island except for the Uplands

V. SOUTH BEACH

South Beach has undergone a complete cycle of development and de-development in the past century. William T. Davis who lamented the advent of the hot-dog stand and "Coney Islandism," would perhaps be pleased to see the empty boardwalks and the long stretches of beach front going back to weeds. Such is the power of water pollution. But when Richmond College is built at Ocean Breeze, South Beach may experience a revival—to the dismay of beachcombers, naturalists, and monarch butterflies.

South Beach is part of the outwash, or apron, plain of the glacier. It is composed of the finest of the glacial debris, material carried out of the morainal mass by melt water and deposited well below it where the streams flowed out over the pre-existing Cretaceous lowland. The fine, reddish sand is prevented from becoming acid (through leaching of soluble carbonates) by the constant accretion of shell material brought ashore on the tide. Along Seaside Boulevard, then, one can see the sort of vegetation which develops where water is a limiting factor but pH and nutrients probably are not.

The theory of vegetational succession in America was first developed by examining the sand dunes at the south end of Lake Michigan. Here Victor Shelford, a pioneer ecologist, worked out the process by which disturbed soils are revegetated and gradually develop over time to an essentially stable plant community. This, of course, entails a gradual change in the species composition of the community until a combination develops which can perpetuate itself indefinitely in the conditions it, itself, creates. This steady-state community is called



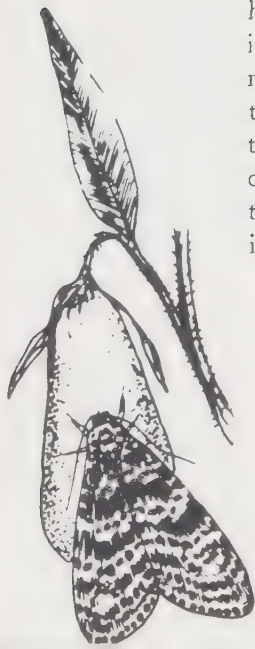
Field horsetail
(*Equisetum arvense*)—
common on sandy soils
everywhere

Between the boardwalk at South
Beach and Seaside Boulevard



a "climax," and the most important breakthrough of Shelford and his colleague, Frederic Clements, was the recognition that the process of succession was determinate, leading to a predictable climax whose nature was a function of climate and soil. The Lake Michigan dunes—or any beach—was ideally suited for developing such a concept. As you walk from the high water line inland you pass through a series of progressively older communities; from the sparse grass just beginning to colonize the dune sand, to the shrub zone often more or less stunted by salt spray, and to the trees blending imperceptibly into the prevalent inland forest type. Shelford visualized the whole series moving outward toward the water as the shoreline itself built outward. Can we see the same process at South Beach?

South of the boardwalk as far as Midland Beach the sand is kept clear of vegetation by the Parks Department, but between the boardwalk and Seaside Boulevard the "weeds" have full sway and here grow the classic species of beach succession. Prominent among them are grasses—New England beachgrass, switchgrass, triple-awn, and sandbur—the last certainly an invention of Satan, if any plant is! Sandbur is a "pioneer" plant, growing in blowouts and other places where the sand has been disturbed, and its incredibly sharp-pointed burs add to it splendidly for going wherever mammals (including man) may go on the beach. Other beach plants have equally spectacular if less painful dispersal mechanisms. The fence around the South Beach Psychiatric Facility is usually festooned with dead, dry vegetable "balls" up to five feet across. These tumbleweeds—not the tumbling pigweed so dramatically seen in "Treasure of the Sierra Madre" but a fairly closely related



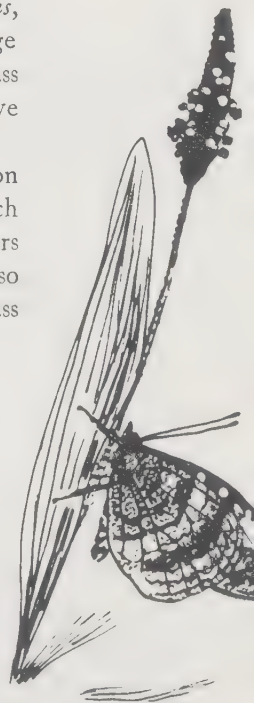
Rattlebox moth (*Utetheisa bella*) and its larval host, rattlebox (*Crotalaria sagittalis*)

plant named *Cycloloma*, an annual which, having matured its seeds in autumn, simply breaks off at ground level and blows long down the beach, scattering them as it goes. (Look at the individual seeds; each is shaped like a little roulette wheel, and rolls along the ground itself, too.) Another fairly common tumbleweed at South Beach is the Russian thistle (*Salsola kali*), which is neither Russian nor a thistle, but rather a goosefoot like *Cycloloma* (albeit a spiny one). Our local specimens of this plant are puny compared to the dimensions it may attain in the southwest, where it is a serious range weed.

Many beach plants have special adaptations to conserve water. Sea-rocket (*Cakile edentula*) is a very unmustard-looking mustard which grows sparingly at South Beach, more commonly at Ward's Point. It is extremely thick and fleshy and makes a fine salad green, though a bit hot and peppery for some people's taste! The seaside goldenrod (*Solidago sempervirens*) is our showiest and largest goldenrod, and the only one with thick, fleshy leaves. As one goes inland many other species of goldenrods also appear on the beach. These, with the abundant small white and large blue asters (*Aster pilosus*, *A. laevis*, other species), are the staple food of the huge swarms of migrating monarch butterflies which each year pass through Staten Island on their way south. We will have more to say of them presently.

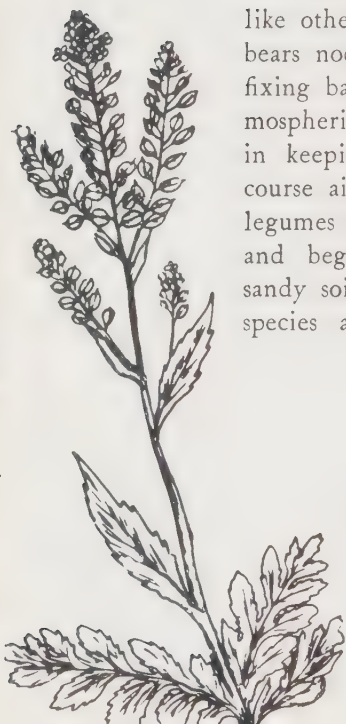
Sweet clover (*Melilotus alba*) is a very abundant plant on the beach. It is a food plant of the sulphur butterflies, which are usually numerous well into November and in mild years even into December. The checkered white butterfly also feeds at South Beach, using the common Virginia peppergrass (*Lepidium virginicum*); it flies into November.

The buckeye (*Precis coenia*) resting on its host, English plantain (*Plantago lanceolata*)



You may notice tufts of a grass-like plant that on second look doesn't look quite "right" for a grass. Break a leaf and observe the white, milky sap. This is goat's-beard, salsify, vegetable oyster, *Tragopogon pratensis*, a plant once much esteemed for its edible root. Today it is seldom eaten, but its large dandelion-like flowers and even larger balls of fluffy seeds are striking objects seldom associated with their commonplace leaves. It is in fact a relative of the dandelion, and this group of genera has given us not only that homely yellow-flowered none-the-less tasty vegetable, but chicory, lettuce, romaine, endive, and escarole as well. We have several species of wild lettuces on Staten Island and all of them are very bitter. It is one of the ironies of man's tastes that he selected this plant originally for its pungent flavor and then proceeded to domesticate it to the point where it has scarcely any taste left at all! But our attention wanders.

The trend in succession is, of course, from herbaceous to woody plants. Here at South Beach one can observe two pioneering trees, the black locust (*Robinia pseudoacacia*) and the dwarf sumac (*Rhus copallina*). Black locust is a legume and like other members of this family (including sweet clover) bears nodules on its roots which contain symbiotic nitrogen-fixing bacteria. Since nearly all living things cannot use atmospheric nitrogen, these bacteria are of immense importance in keeping that essential element in circulation. They of course aid in fertilizing poor soils, and we frequently find legumes such as black locust, bush clover (*Lespedeza capitata*) and beggar-ticks (*Desmodium*) growing on nitrogen-poor sandy soils, enriching them to the point where less tolerant species are able to grow. The Russian olive (*Eleagnus*)



Peppergrass (*Lepidium virginicum*), a very common roadside weed of the mustard family

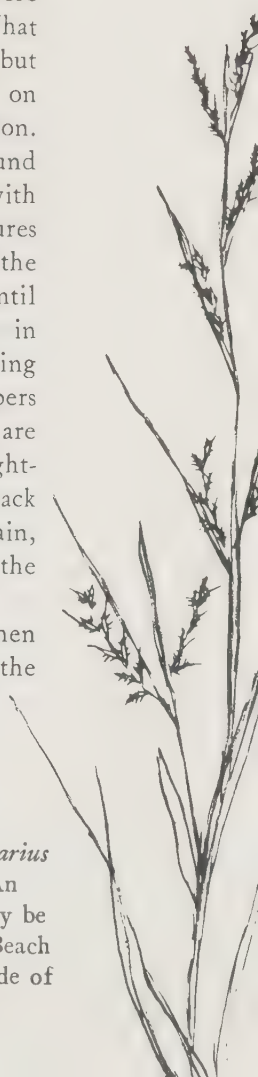
which the Parks Department has been trying to establish along Seaside Boulevard is one of the few non-leguminous plants which also carries N-fixing bacteria.

Dwarf sumac is easily told from other sumacs by the "wings" between the leaflets. It turns a glorious maroon-red in autumn, and its purplish fruits are eaten by many birds. It grows on a variety of dry and sandy soils all over the island and is a very important successional species here.

The climax trees have not yet made their appearance at South Beach, but if the strip along Seaside Boulevard were left undisturbed we could expect them eventually. What would they be? It is safe to assume they would be oaks, but we have no example to look to—all of the coastal plain on Staten Island is too disturbed to support any climax vegetation.

As you walk the beach, look out for insects. Crickets abound here under litter. There are two nearly identical species with different life histories. One overwinters half-grown, matures and "sings" in May and June; the other overwinters as the egg and does not vocalize until July, often continuing until frost. Cricket songs seem to serve to space out the males in territorial fashion, and perhaps also to attract wandering females to them. The beaches have more kinds of grasshoppers than any other communities near New York City. Many are exquisitely camouflaged at rest. When flushed they show brightly colored wings reminiscent of butterflies; the red and black or yellow and black flashes for an instant and disappears again, leaving the predator—or the stroller—perplexed, to say the least.

The best time to walk the beach is early October, when the insect migrations are in full swing. South Beach is on the



Seaside bluestem
(*Andropogon scoparius*
var., *maritima*). An
excellent stand may be
seen in Midland Beach
along the beach side of
Seaside Boulevard

main Atlantic flyway for a variety of mass migrants, of which the monarch butterfly (*Danaus plexippus*) is at once the best known and most spectacular. The studies of Dr. Fred Urquhart at the University of Toronto, using thousands of butterflies tagged with numbered paper bands at release points all over North America, have shown that monarchs converge from all over the northeast to the coast, following the beach south to their wintering grounds in Florida. Along the way they take advantage of the parade of fall flowers, stopping to feed for days when the weather is calm and mild. Under such conditions the lucky beachcomber may be rewarded with the sight of tens of thousands of monarchs at once, as happened to me on October 7, 1971. These butterflies, or their offspring, straggle north singly in May and June to found the summer population for the following year.

The monarch larva feeds on milkweeds, and we now know that most of these plants contain noxious chemicals, called cardiac glycosides (they are related to digitalis, the heart stimulant), which induce vomiting and make the plants generally inedible to most organisms. The monarch is able to take up and store these chemicals without ill effects, thus appropriating the plant's protection for its own use. The yellow and black larva and orange and black adult both seem to flaunt their unpalatability to predators by their bright coloration and the absence of concealment behavior. The viceroy butterfly (*Limenitis archippus*), also found on Staten Island, feeds on willows and poplars and has no such protection, but it closely resembles the monarch and apparently is left alone by predators which cannot tell the difference. We call this phenomenon Batesian mimicry, after Henry Walter Bates, who first observed it in tropical butterflies.



Monarch butterfly
(*Danaus plexippus*)

Evidence is accumulating that most milkweed insects have the same chemical abilities as the monarch; certainly they are a uniformly orange-and-black lot. The milkweed bugs, recently shown to store cardiac glycosides, resemble the monarch not only in color but in habits. They, too, are migratory. As the young (or nymphs) feed up and acquire wings they take off southward, so that as the autumn progresses adults disappear and only the young can be found. These conspicuous insects are gregarious and are to be sought on the pods and seeds of the milkweeds, which by mid-October have dropped most of their leaves.

Several other species of butterflies migrate on the beach, the size and composition of the swarms varying from year to year. The true painted lady (*Vanessa cardui*) is a frequent migrant, often in great numbers, but the American painted lady (*V. virginiensis*) is common every fall on the beaches—its larva feeds on sweet everlasting (*Gnaphalium obtusifolium*), a common plant especially at Great Kills. The big dragonflies (*Anax*, *Epiaeschna*) are migrating now too, sometimes in considerable numbers. And there are day-flying moths in abundance—the corn earworm (*Heliothis zea*), snap-bean worm (*Anticarsia gemmatilis*), and the beautiful orange, black, white, and pink rattlebox moth (*Utetheisa bella*) are all migrants. The commonest moth on the beach, though, is not a migrant at all. It is a drab whitish creature called *Euxoa tetersa*, whose equally drab caterpillar feeds on switchgrass. Little wonder it is so common!

Before leaving South Beach, let us note a recent addition to the flora of New York City—camphorweed (*Heterotheca subaxillaris*). This is a low plant with brilliant yellow flowers

Switchgrass (*Panicum virgatum*), a dominant bunchgrass of damp sand



somewhat reminiscent of dandelions. The leaves, which are hairy and clasp the stem, have a strong camphor odor when crushed. No one seems to know when this southern plant first appeared around New York City, but in the past ten years it has become very abundant on beach sand not only on Staten Island's south shore but all along Jamaica Bay in Brooklyn and Queens. The colonization of new areas by species is a subject of great theoretical and applied interest in biology, yet the opportunity to study it is almost always missed—and this seems to be no exception to the pattern. Still, with its cheery blossoms (which often persist into November) and its contribution to the nectar supply, it is a welcome addition to the vegetation for beachcombers and butterflies alike.



Oaks of acid soils:
basket (*Quercus michauxii*)
and scrub (*Q. ilicifolia*)

VI. *SOME DAYS AFIELD*

There are too many enjoyable and interesting places on Staten Island to catalogue in depth here. I have therefore put together four field trip itineraries which manage to hit a number of them. Each takes the form of a circuit beginning and ending at the Staten Island Expressway, and each can be pursued by car or bicycle or—as I prefer them—on foot. Any of them makes for a fully-packed day of discovery; perhaps their greatest usefulness lies as introductions to localities one can visit individually later, for the whole day if one wishes. Note that parts of these itineraries lie on private property. Signs should be scrupulously observed. Whenever possible, you should attempt to secure permission from the owner before crossing private lands. Many of the unposted lands on the west shore are city land and may be entered freely. If you are using the Hagstrom street map, keep in mind that many mapped streets in undeveloped areas simply *not exist*.

Itinerary 1: *The Serpentine Uplands and the Northwest* (about 10 miles)

Leave the Expressway at Bradley Avenue and proceed south to Brielle, near Susan Wagner High School. At this intersection you are facing a field of little bluestem, the dominant grass of serpentine soils. This is the only known locality in New York State for a tiny butterfly called the Arogos skipper. Bluestem burns regularly because it grows in dry places where it accumulates undecomposed litter. The fire rejuvenates the clumps of bluestem while weeding out plants which



Sweet everlasting
(*Gnaphalium obtusifolium*),
a fragrant beach plant
common at Great Kills Park



are not fire resistant. Can you see evidence of recent fire here? Continue south on Brielle to Rockland Avenue. Notice just beyond Sea View Hospital that the vegetation becomes very sparse; this is exceedingly nutrient-poor serpentine soil. Look among the bluestem for clumps of lichen on the ground. Lichens, which are air-pollution sensitive, are nearly extinct in New York City, except for Staten Island.

Turn left on Rockland Avenue, observing the forest around you. Proceed to the bridle path sign. Proceed into Bucks Head low on the bridle path to your right. This area is a maze of paths leading to vernal ponds, a bog, and serpentine upland vegetation, much of which burned in the spring, 1971 with the fires. Atop the hill—but difficult to locate—is the old Heyerdahl property. Terraces and the remains of vineyards can be found, along with foundations and one of the finest views in New York City, especially in autumn. Among Bucks Head low surprises are a grove of persimmon trees, the chorus of spring peepers in April, riots of purple gerardia flowers in September, fine specimens of basket oak and swamp white oak. The longest path will bring you out on Forest Hill Road. Let's assume you get back to Rockland Avenue.

Proceed to Nevada Avenue. Turn left to High Rock Park Conservation Center. Here is a reasonably intact plot of climax oak forest with a boggy marsh, a pond, and many trails—and of course the Center itself, with interpretive exhibits and a staff well schooled in both Island natural history and the principles of ecology. Before you leave be sure to join the Friends of High Rock. (While in the park, watch for beech-drops [*Episagus*], a little, broom-like parasitic plant which grows on the roots of beech trees.)



Purple-headed sneezeweed
(*Helenium nudiflorum*),
confined on Staten Island
to the Willowbrook State
School grounds

Returning to Rockland Avenue, proceed south to Richmond Road, then right all the way to Arthur Kill Road in Richmondtown. You have just skirted the edge of the serpentine plain. To your left is the flat apron plain—New Dorp and Great Kills. Walk right a few feet on Arthur Kill Road/Richmond Hill Road, to the hard left just beyond Saint Andrew's Church. (The Church and its graveyard are another beautiful, serene, and historically significant stop.) This cow path is Old Mill Road, and it is a dead-end. Scramble up the hill to your right. It, too, is honeycombed with trails. Another mass of naked serpentine, it is clothed in bluestem and other fire-tolerant and serpentine-tolerant plants. At one point just west of the golf course a spring emerges from the ground. Note the luxuriant vegetation around it compared to the surrounding area. The ailanthus trees here are often beset with the silken nests of the ailanthus webworm, the larva of a beautiful but tiny orange moth with black-rimmed yellow spots. From the crest of this hill one can see the western edge of the serpentine as it drops below the vast flatlands that were the Fresh Kills and are now becoming the Bloomfield and Fresh Kills landfills and the shopping centers on Richmond Avenue. Note the zonation of vegetation along the hill, clearly visible from here, and the many gulls feeding on garbage at the landfills virtually any day of the year.

Returning to Richmond Hill Road, continue north to Rockland Avenue, then left to Richmond Avenue. Travel north, stopping at Willowbrook Park to look at the well-developed, lowland pin oak forest and at the pickerelweed marsh near the Victory Boulevard entrance, and continuing on Richmond Avenue to Forest Avenue, Graniteville. Turn

Gerardia (G. purpurea)—
a showy late-summer flower
of sandy soils throughout
Staten Island

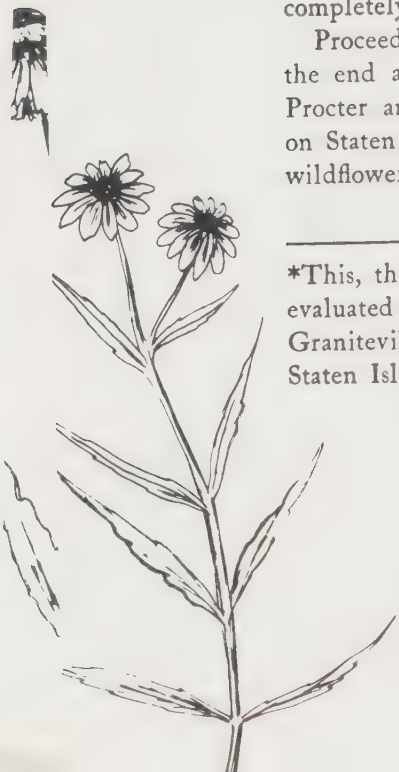


left. Stop at Simonson Avenue and cross the street to a large open area with exposed bare rock. This is an old diabase quarry. Diabase, an igneous rock, is the stuff of which the Palisades on the Hudson are made and this outcrop is actually part of the same formation.* Near Forest Avenue is an extensive stand of partridge pea (*Cassia fasciculata*), a small yellow-flowered plant whose pinnate leaves fold slowly when touched. You may see the yellow little sulphur butterfly (*Eurema lydia*) here after July. Note the sparse vegetation on the thin layer of decomposed diabase. Note also how the rock flakes and sloughs off in chunks, a process called exfoliation.

After leaving the quarry continue west to South Avenue. Turn right (north) to Arlington Place and walk in to observe an acid sand-barrens vegetation adjoining the Arlington Road Yard. (Do not enter the Yard without permission.) Here may be found sweet pepperbush, highbush blueberry, sheep laurel, and bunchtop bluestem. If you explore the area fully you may find other interesting things, including a many species completely invisible from the road.

Proceed on South Avenue to Richmond Terrace; left at the end at Port Ivory. Here, on your left just before the Procter and Gamble plant, is one of the largest vacant areas on Staten Island—a splendid place to learn one's weeds and wildflowers! Note that, although the prevailing soil type is

*This, the orthodox interpretation of the quarry, is being evaluated at this writing. Microscopic examination of the Graniteville material may reshape our understanding of this Staten Island landmark.



Showy sunflower (*Helianthus rigidus*), adventive in disturbed habitats at Willowbrook and Howland Hook

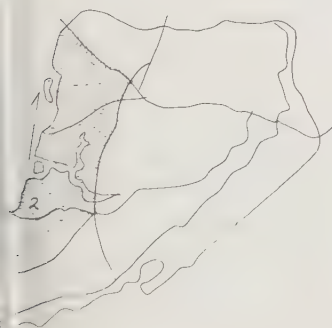
West shore is acid sand, this area is made of a red, seemingly non-acid clay. Why?

Follow Western Avenue through the reed marshes which are being converted into the Howland Hook Distribution Center. At the Goethals Bridge turn right instead of left and hike back along the waste ground and salt marshes fronting the Kill. (Be sure to use mosquito repellent!) There are many frogs here, as well as a variety of unusual insects and plants. Nearby is a large colony of catnip. See if you can find it. The huge sunflowers which bloom here in fall are found in "dump" type habitats all over America and belong to the same species as the cultivated type.

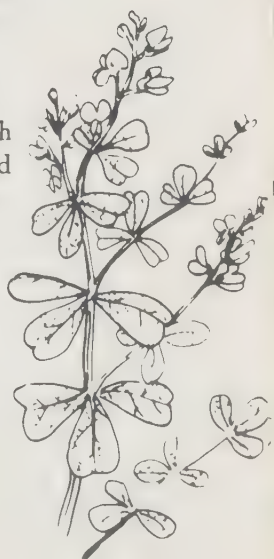
Return to Forest Avenue and proceed east to Morrow Avenue. Loop around, taking time to walk back into the area described in Chapter III and explore it carefully—beware of marsh mosquitoes! You may re-enter the Expressway at the Goethals Bridge approaches. As you head toward the bridge notice the gray piles of rock on your right, adjoining the container-storage yard. This is schist bored out by the excavation of the Brooklyn-Staten Island water tunnel under New York Bay. Although this pre-Cambrian rock probably underlies all of Staten Island, it is everywhere covered by younger materials. Many fine mineral specimens have been found in this rock pile, as well as decorative banded boulders for rock-garden use; and anyone can find his own (poor quality) garnets here.

2: The West Shore (about 28 miles)

Leave the Expressway at South Avenue and proceed south on Travis Avenue, stopping en route to examine the bogs and



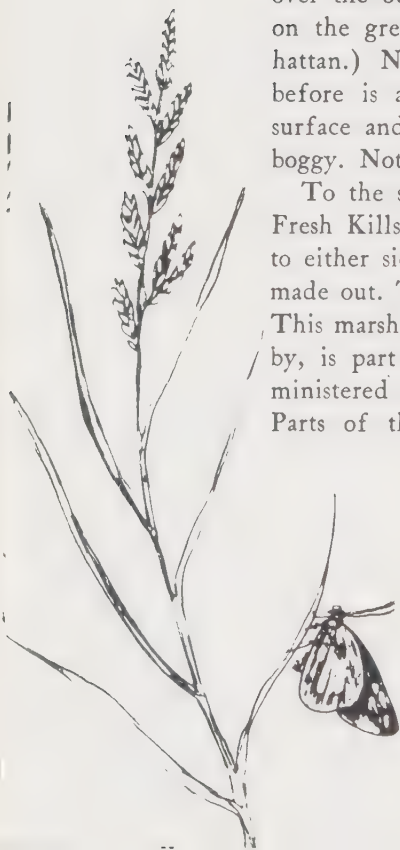
Wild indigo (*Baptisia tinctoria*), found on acid sandy soils throughout the Island; flowers, bright yellow



acid sand barrens described in Chapter I. In spring walk for the abundant wildflowers that blanket the floors of swamp forests. Left on Travis Avenue to Victory Boulevard. At the south corner is a large open field filled with switchgrass at its lower end and bunchtop bluestem at upper. Can you guess why the vegetation seems so unusual?

Just beyond Victory Boulevard hike into the brush on your right (before the Main Creek Bridge). The path, well-defined, is not hard to locate. When you come to a thicket of dwarf sumac cut through it to your right and you will emerge on a large rock outcrop. This is also Palisades diabase. It is the southernmost exposure of it, in fact, and the path you passed (and may not have noticed!) on your way in is in an old quarry. Examine the rock surface carefully and you will see that it bears parallel grooves, or striae, made by rock fragments embedded in the ice as the glacier moved over the outcrop. (This phenomenon is very easy to observe on the great outcrops of mica schist in Central Park, Manhattan.) Now do you see why the meadow you looked at before is an acid grassland? The rock lies just below the surface and the entire area is poorly drained and decidedly boggy. Note that the rock here also exfoliates freely.

To the southeast lies the Main Creek estuary, part of the Fresh Kills system. It is best viewed from the bridge, where to either side a clear pattern of vegetational zonation can be made out. This is the same pattern described in Chapter II. This marshland, along with the swamp forest and brush nearby, is part of the William T. Davis Wildlife Refuge, administered by the Staten Island Institute of Arts and Sciences. Parts of the Refuge have paths; descriptive materials are



Alkali grass (*Distichlis spicata*) and the salt marsh skipper (*Panoquina panoquin*) which feeds on it; both from Fresh Kills

available at the Institute, 75 Stuyvesant Place, Saint George.
 At the end of Travis Avenue turn right and proceed south
 to Arthur Kill Road. Observe the Fresh Kills marshes and
 the landfill, said to be the world's largest. You may wish
 to hike on the "inactive" part of the landfill, accessible by
 climbing over the earthen barrier, or berm, opposite the
 Corvette's shopping center. It is a vast area with a complex
 weedy vegetation, including large stands of summer-cypress
 (*Kochia scoparia*), a weed of the goosefoot family seldom
 seen elsewhere in the city. What is the successional potential
 here?

Right on Arthur Kill Road. Note the colored clays in the
 embankment of the West Shore Expressway, under construc-
 tion. These are from the Kreischerville deposits, which you
 will see later. Turn left on Huguenot Avenue to Woodrow
 Road. The heights in Woodrow are described in Chapter II.
 Right on Woodrow Road, passing the Woodrow bog near
 Kissville Avenue with sedges and buttonbush at the near end.
 From Woodrow Road explore Winant Avenue and Blooming-
 dale Road, both of which dead-end at the Expressway. Be-
 tween them lies the main pine barrens-blackjack oak area,
 with its many rare plants. On Bloomingdale Road are large
 stands of the sweet fragrant goldenrod (*Solidago odora*).
 This species resembles seaside goldenrod but is more slender
 and less fleshy. Most, but not all, individual plants smell
 strongly of anise when a leaf is crushed in the hand. It is
 a typical pine-barrens plant.

Follow Bloomingdale Road south (across Amboy Road it
 becomes Sharrott Avenue). After crossing a large rise you
 dip down to Hylan Boulevard. The rise was the glacial

pink rose-mallow (*Hibiscus*
moscheutos). A fine
 example of this showy
 species is in Wolfe's
 Park



terminal moraine, which cuts across Mount Loretto as a ridge of low, rounded hills, cutting Hylan Boulevard and extending to the Princes' Bay Light on your left. The southwestern corner of the Island was, then, glaciated. (Below the Light, erosion of the sea-cliff has exposed the unconformity between the coarse glacial material and the finely bedded Cretaceous sands and clays below. To see this you must cut across Mount Loretto land to the shore; ask permission.)

Continuing west to Tottenville, observe all around you the charred remains of woodlands burned in the great 1962 wild-fire. Under the dead hulks, great numbers of sassafras, birch, and oak saplings are developing. Many of these fields will abundantly repay close examination; in fact any of the small side streets from Page Avenue west is likely to be undeveloped and to lead to something interesting. There are many small ponds and bogs here, as well as a few pockets of acid sand with blackjack oak and rare pine-barren plants.

A large block of burned, revegetating land extends south of Hylan Boulevard along Aspinwall, Finlay, and Connecticut Avenues. Here grow some of the Island's showiest wild flowers of late summer and autumn—the New York ironweed (*Vernonia noveboracensis*), three species of pink-purple Joe Pye Weeds (*Eupatorium purpureum*, with domed flower cluster and aromatic leaves in 3's or 4's; *E. fistulosum*, similar but not aromatic and the leaves usually in 6's; *E. maculatum*, flat-topped, leaves in 4's and 5's), at least seven asters (*Aster novae-angliae*, *A. laevis*, *A. ericoides*, *A. lateriflorus*, *A. pilosus*, *A. cordifolius*, *A. puniceus*) and perhaps a dozen goldenrods, the gray thistle (*Cirsium discolor*), and a riot of butterfly weed (*Asclepias tuberosa*) with at least a few of the



Smooth aster (*Aster laevis*), a variable and abundant blue aster

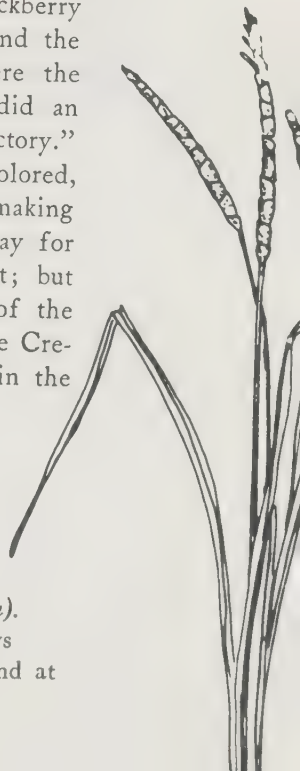
rare lemon-yellow variety. Within this area, too, is a large colony of mountain mint (*Pycnanthemum muticum*), an inconspicuous unmint-like plant with a very strong odor of pennyroyal when crushed. And, though they are easily missed, two rare plants growing here are also worth looking for: feverwort (*Triosteum perfoliatum*), with showy orange fruits in early fall, and purple milkweed (*Asclepias purpurascens*), similar to common milkweed but much more deeply colored and showy.

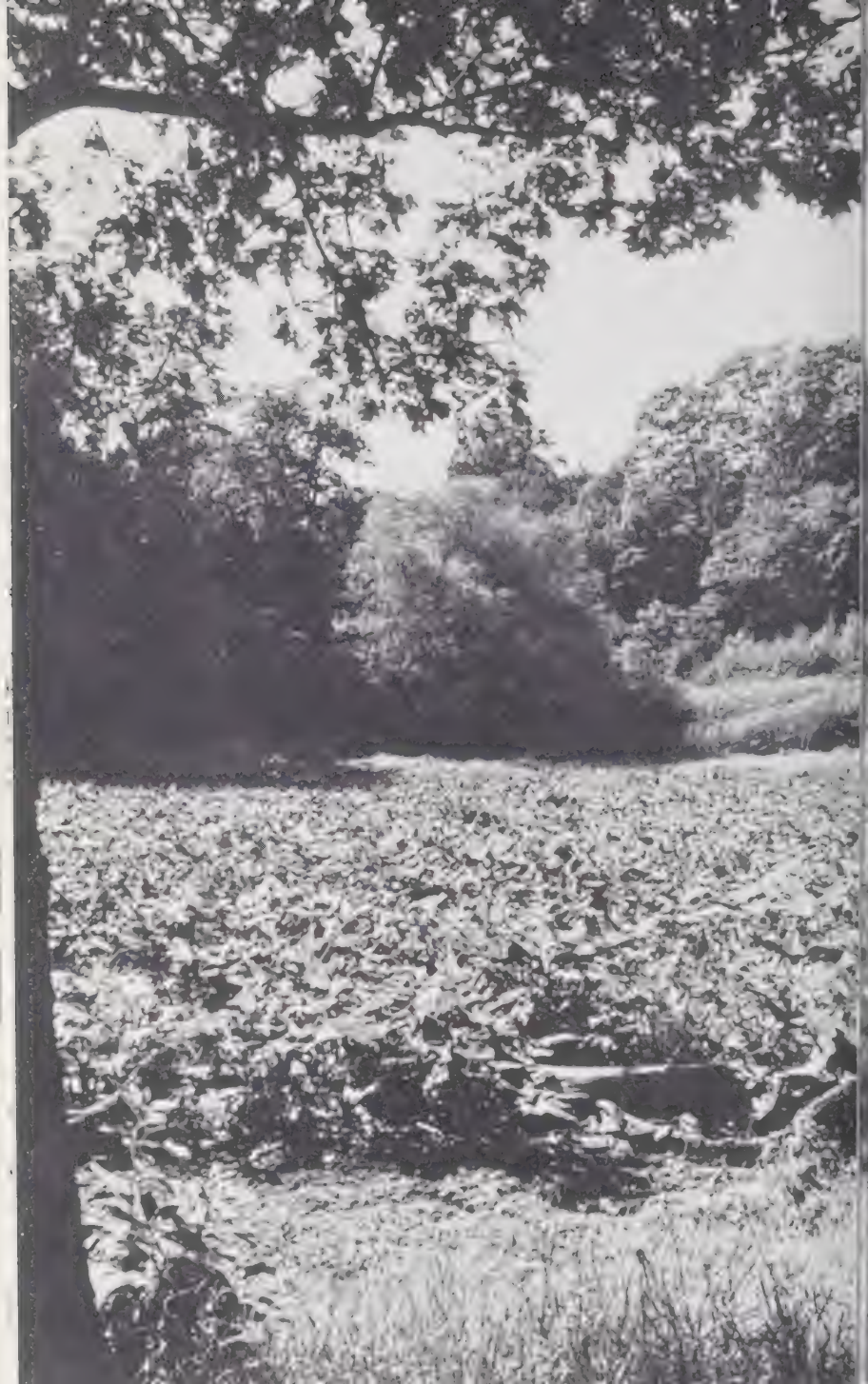
The tip of Tottenville has a rich soil that supports hackberry groves, and with this tree one can find the snout butterfly (*Libytheana bachmannii*) and the gray emperor (*Asterocampa celtis*), both considered rarities around New York. Among the rarer understory plants are giant hyssop (*Agastache nepetoides*) and motherwort (*Leonurus cardiaca*), two large, distinctive mints; and the annual purple loose-strife (*Lythrum hyssopifolia*).

Re-cross Hylan Boulevard and, passing through Tottenville proper, pick up Arthur Kill Road northbound. Hackberry appears before the Outerbridge Crossing. Just beyond the bridge is Kreischerville, now called Charleston. Here the Kreischer brick works operated for many years, as did an indigo dye works known locally as the "blue factory." The Cretaceous beds here are complex and brightly colored, containing clays with excellent brick- and ceramic-making potential. Unfortunately, they are being excavated today for use as landfill on the West Shore Expressway project; but a few remaining clay pits provide a vivid picture of the eroding materials deposited by flowing water during the Cretaceous and again at the time of glacial melt. Walk in the

Jointgrass (*Tripsacum*).

This huge grass grows
on Old Mill Road and at
Tottenville





pits and examine the polished pebbles and cobbles and the array of clays and sands. Many plant fossils have been found here. Note especially the purple limonitic concretions, many of which are hollow or contain yellow sand.

Continue north on Arthur Kill Road to Rossville Avenue and beyond, retracing your route to the Expressway. (You may wish to stop at Public School 4 in Kreischerville to examine its unique architecture and its Kreischer bricks, and at the Blazing Star burial ground, one of the Island's oldest, in Rossville near the foot of Rossville Avenue.)

Day 3 *The South Shore* (about 23 miles)

This trip is almost completely on the unglaciated coastal plain, but it begins in the serpentine uplands. Exit from the Expressway at Richmond Road and proceed south along the flank of the escarpment to Spring Street. The cul-de-sac at the end of this street adjoins a large exposure of weathering serpentine which has been blasted and from which the soil has been stripped. This body has yielded some of the Island's finest mineral specimens, including large crystalline masses of artinite and bizarre encrustations of fungus-like hydromagnesite. Behind it is a gas pipeline-cut extending up the side of Todt Hill. Hike this, observing the rich oak forest which can develop where granitic moraine enriches a serpentine substrate. (Remain on the cut; the surrounding woods are private property, and posted as such.) Almost a mile up the trail is a marsh tucked into an undrained depression on your right as you ascend. This lovely spot is Reed's Basket Willow Swamp, and a movement is afoot to have it preserved as a park. It is most notable for its rich bird population, including

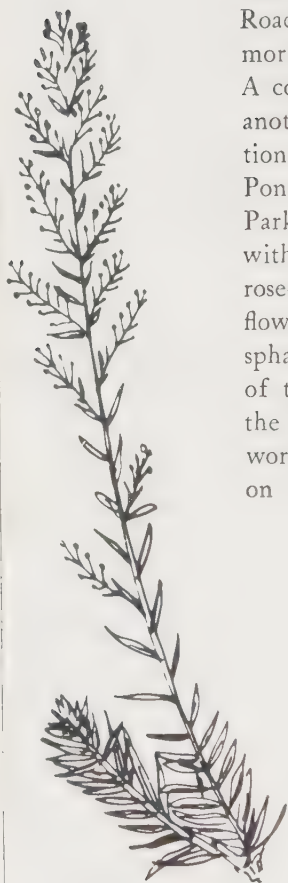
Jack-in-the-pulpit
(*Arisaema triphyllum*)—
still common in woods
throughout the Island



many redstarts and scarlet tanagers. The woods here are very productive of colorful fungi in damp weather, including the poisonous fly amanita and the bright red emetic russula.

Returning to Richmond Road, proceed south through Dogan Hills. The vicinity of Four Corners Road is the head of the old iron-mining district. Serpentine is rich in iron which tends to be leached out by ground water and concentrated as deposits of limonite in lowlands. Until better quality ore became available upstate, these Todt Hill deposits were worked commercially; there is still plenty here, and a casual walk will turn up fist-sized nuggets of spongy limonite or the pisolitic variety, composed of globular iron masses embedded "pudding-style" in a less dense matrix.

Leave Richmond Road where it turns westward at Richmondtown, hugging the escarpment. Proceed south on Ambrose Road through the rolling wooded topography of the terminating moraine to Segune Avenue, thence left to Hylan Boulevard. A couple of blocks further south is the Lemon Creek estuary, another tidal marsh with clearly defined vegetational zonation. Return northeastward on Hylan Boulevard to Wolf Pond Park. On the north side of the Boulevard opposite the Park sign, following a winding trail through woods alive with wildflowers in April and May to a pond with swart rose-mallow (*Hibiscus palustris*); one of our showiest wildflowers, it blooms in July. At one end of the pond is a little sphagnum bog. Across Hylan Boulevard the beachfront side of the park has some rare plants—*Eupatorium hyssopifolium*, the linear-leaved boneset (also seen at Great Kills), and the wormwood (*Artemisia caudata*) which is not known elsewhere on the Island.

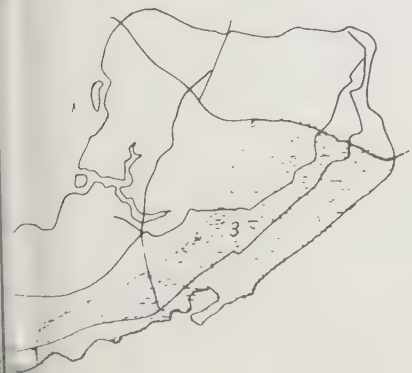


Pinweed (*Lechea racemosula*).
Several pinweeds occur
on beach and other
sands; note the tiny
flowers

Continue north on Hylan Boulevard, taking time to investigate fields, brush, and side streets. Enter Great Kills Park at the sign near Emmet Avenue and hike from the south parking lot out to Crooke's Point. This is a fine area to visit from mid-September to early November, when migratory insects and birds are both at their best and the goldenrods and asters at their showiest. Note the vast areas of hydraulic landfill occupied by tall reed to the virtual exclusion of all other vegetation. Along the trails through it one finds Mexican tea (*Chenopodium ambrosioides*), a plant one usually thinks of as an urban weed. Crush and smell it! An antihelmintic tea is made from its seeds. On the beach, look for the tiny banded stems and pink-white flowers of jointweed (*Polygonella articulata*) in September and October; the fuzzy gray-green foliage of beach heather (*Hudsonia*) showing yellow star-shaped flowers in May; the dense mats of pin-weeds (*Lechea*), usually with last year's red-brown stalks and seed capsules attached; and the abundant fruits of the bayberry.

Observe the sanderlings running in and out along the tide, foraging in the detritus washed ashore.

Hylan Boulevard is a rather sterile road between Great Kills and the Expressway. Follow Midland Avenue (right east) to Seaside Boulevard. Midland Beach, down-at-the-heels today, has many interesting back alleys and much brush and sand. Most of the strip from Midland Avenue to Vulcan Street north of Seaside Boulevard is filled-in tidal marsh and contains extensive stands of reeds which in July produce millions of the broad-winged skipper butterfly (*Poanes viator*). This primitive insect has a large, robust caterpillar



Camphorweed (*Heterotheca subaxillaris*)—abundant in South Beach



which feeds on reeds and certain native marsh grasses; there is only one brood each year. There can be no doubt that by creating habitats suitable for reeds, man has greatly increased the abundance of this insect.

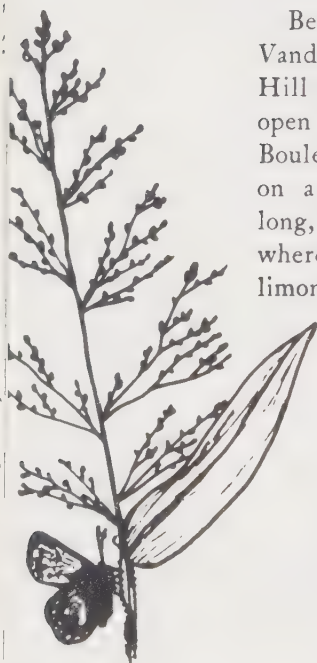
Walk between the Boulevard and the boardwalk and look for the things described in Chapter V. It is surprisingly easy to walk to those high-rise apartments at the foot of Fort Wadsworth—so long as you don't acquire sandburs! If the weather is good the view of the Verrazano Bridge and Coney Island is pleasant.

You can return to the Expressway from Lily Pond Avenue, with the highlands rising to meet you once again.

Day 4: The Northeast (8 miles)

This is a relatively short excursion in the most congested parts of the Island. Note that traffic flow patterns in Stapleton and Tompkinsville are undergoing changes and the preferred routing suggested here cannot be followed by automobile. Watch for one-way signs or, better yet, leave your car on Fort Street or Victory Boulevard and hike the segment centered around Saint Paul's Avenue.

Beginning at the Richmond Road exit, travel north on Vanderbilt Avenue to Osgood Avenue, just north of the Park Hill Apartments, and follow it right to the end. The large open area extends to the railroad tracks and beyond to Hyatt Boulevard. Most of this area is a bluestem barrens developed on a soil composed essentially of decomposed limonite. A long, low ridge extends parallel to Vanderbilt Avenue, where this is gullied by stream erosion large nuggets of limonite, some with geode-like encrustations of gray-green



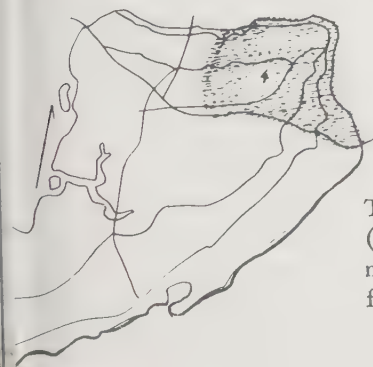
Panic grass (*Panicum clandestinum*) and the hobomok skipper (*Poanes hobomok*), which feeds on it

quartz crystals, may be seen. The vegetation has a very low species diversity, having been stringently selected by both soil and fire. A series of ponds marks the southern part of the area. In summer great blue heron can usually be seen here.

Turn left on Tompkins Avenue, passing through Clifton, and proceed to St. Paul's Avenue (if on foot via Canal, Wright, Van Duzer and Cebra). Note the irregular topography as you rise into the serpentine uplands. Turn left from St. Paul's onto Paxton Street and around Homer to Swan. Stop at the latter corner and ascend the cliff facing almost due north (follow the seep of water from a spring emerging about half-way up). Look for mineral asbestos in rock exposures. Note the features described in Chapter IV on the cliff and at the base. If it is autumn note particularly the great profusion of blue asters (*Aster laevis*). Some 25 species of butterflies have been found here.

Returning to St. Paul's Avenue, proceed north to Victory Boulevard and west to Jersey Street. Turn left from Jersey Street on Brighton Avenue to Lafayette Avenue. Across from the Goodhue Playground is a hillside denuded of vegetation. This exposed serpentine is weathering very differently from that at Homer Street. Here there is a high iron content and much of the material is stained yellow by the iron oxide pigment, ochre. The summit of the hill has a serpentine barrens vegetation including a great deal of bush clover (*Lespedeza capitata*). There is an excellent view of the northeast part of the Island from P.S. 17, at the north end of the undeveloped area.

Follow Brighton Avenue to Forest Avenue, then right,



The checkered white
(*Pieris protidice*):
male above,
female below



through West New Brighton to Clove Road, which will take you back to the Expressway. The picturesque Clove Valley is a geologic fault with a series of extensively man-modified ponds. The uplands on either side, especially on the south side in the main part of the park, support an oak forest in surprisingly good condition. In early spring large numbers of dusky wing butterflies (*Erynnis*) and mourning cloaks (*Nymphalis antiopa*) may be seen defending territories along paths on the hill overlooking the skating rink at Victoria Boulevard. Parts of these uplands burned several years ago. Like similar areas in Latourette Park overlooking Bucks Head low, they are covered now with virtually impenetrable thickets of thorny greenbriers. There are limonite deposits in this area as well; watch for nuggets underfoot.

* * *

"How to keep—is there any, is there none such, now known some, bow or brooch or braid or brace, lace, latch catch to keep

Back beauty, keep it, beauty, beauty, beauty . . . from vanishing away?"

Gerard Manley Hopkins, *The Leaden Echo and the Golden Echo*

AFTERWORD

One does not learn the byways of so diversified an area as Staten Island without "a little help from one's friends." And so I would like to thank those Islanders who shared their knowledge of the woods, trails, and bogs with me during my eighteen months there, and whose company greatly enriched my own "days afield": the Richard Buegler and Herman Waage families; George Pratt and Mathilde Weingartner of the Staten Island Institute; Harry Betros and Rudolf Lindenfeld of High Rock; and Howard Cleaves, Staten Island's master birder. As they all know, all sins of commission or omission in this little book are mine. I know there are many, at least of the latter. There is a great deal to see and to learn and, unfortunately, so little time in which to do so!

abgrass (*Digitaria*),
ubiquitous lawn and
cant-lot weed



FIELD LIST

The purpose of this listing of plants, insects, and other natural features mentioned in this book is to provide a quick key to specific items which the hiker may wish to observe. A secondary purpose is to underscore lightly the great variety of natural materials still found within the boundaries of the borough of New York City.

Latin names, although used in the book with the common names, generally are not included in this list. Page numbers printed in *italic* are those on which illustrations of the material can be found.

amanita, fly 48
 ant, Allegheny mound-builder 17
 asbestos 25
 aster: *cordifolius* 44, 49
 ericoides 44, 49
 laevis 31, 39, 49, 51; 44
 lateriflorus 44, 49
 novae-angliae 44, 49
 pilosus 31, 44, 49
 puniceus 44, 49
 bayberry 49
 beachgrass, New England 30
 beech-drops 38
 beggar ticks 32
 birch 44
 bladderwort 11
 blue asters 39, 44, 51; 44
 blueberries 13
 —highbush 17; 20, 40
 bluestem 39, 40
 —bunchtop 11; 18-19, 40-42
 —little 26, 37; 26
 —seaside 33

linear-leaved boneset 48
 buckeye butterfly 31
 bur-reed 8; 11
 butterflies:
 American painted lady 35
 arogos skipper 37
 broad-winged skipper 49
 buckeye 31
 checkered white 31; 51
 dusky wing 52
 elfin 20
 gray emperor 45
 hairstreak 20
 hobomok skipper 50
 little sulphur 40
 monarch 31, 34; 34
 painted lady 35
 salt-marsh skipper 22; 4
 snout 45
 spring azure 12
 sulphur 31
 viceroys 34
 butterfly weed 44
 buttonbush 11, 43

- buttonweed 16
- camphorweed 34; 49
- catbriar 16, 52; 16
- catnip 41
- chestnut, American 16
- chokeberries 20
- lover, sweet 23, 31; 23
- bush 32, 51; 25
- cordgrass 22
- corn earworm 35
- crabgrass 53
- cranberries 11
- dress, hoary 27
- diabase 40, 42
- dragonflies 35
- egret, snowy 19
- ferns, cinnamon 22
- bracken 17
- everwort 45
- gabane, salt marsh 22, 23; 22
- gamflower 12
- goxtail, giant 24
- grasses 41
- guttardia, purple 38; 39
- hat's-beard 32
- goldenrod, white 26
- silver 26
- seaside 31, 43; 27
- fragrant 43
- little gray 26
- grass, alkali 22; 42
- briar 52; 16
- pondsel-tree 23
- psy moth 17, 18; 14
- blackberry groves 45
- lather, beach 49
- map, water 22
- heron, great blue 19, 51
- high-tide bush 23
- honeysuckle, Japanese 26
- horsetail, field 28
- hyssop, giant 45
- indigo, wild 41
- ironweed, New York 44
- Jack-in-the-pulpit 47
- Joe Pye weeds 44
- jointgrass 45
- jointweed 49
- kingfisher, belted 19
- knotweed, Japanese 26
- laurel, mountain 13
- sheep 13, 17, 40; 17
- lichen 38
- locust, black 32
- loose-strife, winged purple 35
- annual purple 45
- mallow, swap rose- 37, 48; 43
- meadow-beauty 10
- Mexican tea 49
- milkweed bugs 35
- milkweed, purple 45
- milkweeds 34
- motherwort 45
- mountain mint 45
- oak, basket 36; 38
- bear 17; 36
- blackjack 14, 43, 44; 13
- pin 16, 39
- post 16; 13
- scrub 17; 36
- swamp white 38
- orach 22; 22
- panic grass 50

- paper mulberries 26
 partridge pea 40
 peat moss 10, 11
 peppergrass 32
 —Virginia 31
 persimmon trees 38
 pickerelweed marsh 39
 pine barrens 8-12, 43
 pink, Southern swamp 17
 pinweeds 49; 48
 pitch pine 13; 18
 pitcher plant 11
 plantain, English 31
 rattlebox 30
 rattlebox moth 35; 30
 redstarts 48
 ribbed-cocoon-maker 18
 (rubbed dart) under
 euxoa detersa 35
 Russian olive 32-33
 Russian thistle 31
 russula 48
 St.-John's-wort, weedy 11
 —bog 11; 10
 salsify 32
 salt marsh 15
 saltwort 19
 sandbur 30
 sanderlings 49
 sassafras 44
 scarlet tanagers 48
 searocket 31
 sedges 43
 —bog 12, 43
 —tussock 12
 serpentine 24-27, 37, 39, 48, 51
 smilax 16; 52
 snap-bean worm 35
 sneezeweed, purple-headed
 sour gum 12
 sphagnum 10, 48
 spring azure butterfly 12
 spring peepers 12, 38
 sweet everlasting 35; 37
 sweet pepperbush 40
 switchgrass 30, 35, 42
 sumac, dwarf 32-33, 42
 summer-cypress 43
 sundew 11
 sunflower, showy 41; 40
 tall reed 11, 22, 49
 terminal moraine 44, 48
 thistle, gray 44
 triple-awn 30
 tumbleweed 30-31
 vegetable oyster 32
 violet, lanced-leaved 20; 2
 —primrose-leaved 17
 woodcock 19
 wormwood, tall 48



PROCEEDINGS

Staten Island Institute of Arts and Sciences



CONTENTS

Articles

AULACODISCUS SPECIES OF THE SIMBIRSK FLORA Joseph F. Burke and Warren E. Flint	59
THE BLACK WIDOW SPIDER ON STATEN ISLAND Arthur M. Shapiro	69
BIRD COUNTS ON STATEN ISLAND, 1972 Mathilde P. Weingartner	72

STATEN ISLAND INSTITUTE OF ARTS AND SCIENCES

Officers, Trustees, and Staffs for 1971-1972	78
Treasurer's Report, 1971-1972	81
Officers, Trustees, and Staffs for 1972-1973	83
Treasurer's Report, 1972-1973	86

Book Reviews

"A Study of Bird Song" by Edward A. Armstrong	75
"The Encyclopedia of Geochemistry and Environmental Sciences" edited by Rhodes W. Fairbridge	76
"Pollution, Profits & Progress" by Henry A. Schroeder, M.D.	77
IDEX: Volume 27, Number 3	90

Editor: G. K. Schneider

Volume 27, Numbers 1 and 2, of the PROCEEDINGS of The Staten Island Institute of Arts and Sciences appeared as the book, "New York City's Last Frontier: Field Trips on Staten Island," by Arthur M. Shapiro, published in Spring 1973.

This is Number 3 of Volume 27. The INDEX on page 90 refers to material in this number only.

Published November 1973 by The Staten Island Institute of Arts and Sciences, 75 Stuyvesant Place, Staten Island, New York 10301.

Aulacodiscus Species of Simbirsk Flora

by JOSEPH F. BURKE and WARREN E. FLINT

The fossil marine diatoms of the U.S.S.R. received the attention of diatomists commencing with the discovery of a deposit of diatomaceous earth at Beklemischewo in 1854.¹ Other deposits were found later.

The studies were conducted mostly outside of Russia, with publications in the German and English languages. This foreign scholarship encountered certain difficulties, because of the language barrier, especially with respect to geographic location of the various deposits and with place names.

The study and publication on diatoms by Russian scientists commenced after World War II by which time the bulk of the presently known species of the classic deposits had been described in foreign publications. There are now numerous new deposits not as yet well known to diatomists outside of Russia.

The Volga River basin, particularly in the government of Simbirsk, now named Ul'yanovsk Oblast, was the locale of the earlier studied deposits and for convenience the species found therein may be referred to as the Simbirsk flora.²

With this article is illustrated that portion of the Simbirsk flora represented by the genus *Aulacodiscus*. Only generally found species are included, forming a basic *Aulacodiscus* flora by which the Simbirsk flora may be recognized. Rarities are omitted.

The localities of Ananino, Archangelsk-Kurojedowo, Baryche, Carlovo and Inza have been the sources of the specimens. These geographic names are given as usually transliterated.

¹ Joseph F. Burke and John B. Woodward, A. Review of the Genus *Aulacodiscus*, p. 233, April 5, 1969. Published by Staten Island Institute of Arts and Sciences.

² Joseph F. Burke, A Review of the Genus *Aulacodiscus*, pp. 327-329, February 9, 1971. Published by Staten Island Institute of Arts and Sciences.

The provenance of the samples of material used in this study is not readily traceable. Often a sample has been divided and subdivided as it has been handed down over several generations of diatomists. The possibility of contamination is a specter that haunts the reviewer. It is important that the flora of a deposit or of an area be determined correctly so as to form a guide to the detection of any adventitious species.

The presence in the same deposit of *A. apedicellatus* and *A. concinnus* was explored previously.³ An attempt was made to indicate their possible confinement to separate deposits, but in this study *A. apedicellatus* has been found in samples or prepared slides from all of the five localities and *A. concinnus* in all but **Carlovo**.

A. apedicellatus as a species has not been well developed in the literature but studies as yet unpublished by E. C. P. Bone, of Sussex, England, have done much to bring about a better understanding of it.

Two available samples of Inza material differed in the presence or absence of *A. archangelskianus*. It was in a sample used by S. H. Meakin, Sheffield, England.⁴ None was found in an Inza sample originating with A. Elger, Eutin, Schleswig-Holstein.

A. glacialis, *A. prominens* and *A. simbirskianus* are three species lacking comprehensive treatment in literature. All are conspicuous in the Simbirsk flora.

A. lahusenii was subdivided by Witt at the time of original publication; later others added additional varieties. It is a problem to determine whether a specimen is one or another of the varieties and it might be better if the species and its varieties were considered a single taxon.

A. lahusenii v. *lahusenii* and *A. lahusenii* v. *punctatus* are found in the Simbirsk flora.

A. probabilis was confused by A. Schmidt, on pl. 36 of his Atlas der Diatomaceenkunde, 1876, with *A. brownei*, but the latter is confined to the west coast of North America where it is found both recent and fossil.

A. excavatus is uniform in appearance in the Simbirsk flora though subject to variations elsewhere among Russian deposits. In this study *A. septus* is considered to include *A. schmidtii*. *A. quadrans* completes this version of the Simbirsk flora.

³ *ibid.* p. 335, May 31, 1971.

⁴ *ibid.* p. 352, June 25, 1973.

Archangelsk-

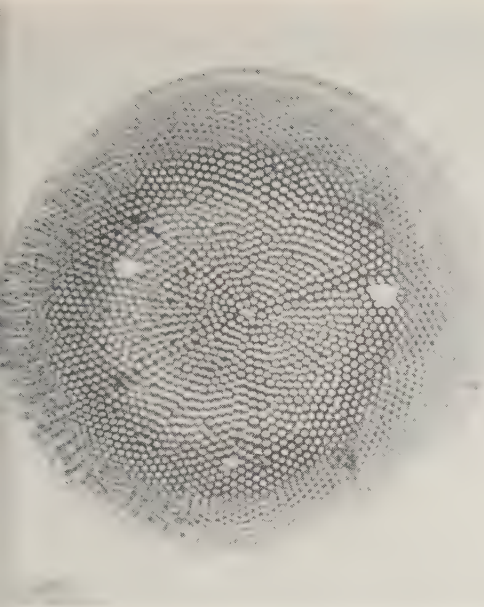
	Ananino	Kurojedowo	Baryche	Carlovo	Inza
<i>apedicellatus</i>	x	x	x	x	x
<i>archangelskianus</i>					x
<i>concinus</i>	x	x	x		x
<i>excavatus</i>	x	x	x		x
<i>glacialis</i>	x	x	x	x	x
<i>lahusenii</i> v. <i>lahusenii</i>					x
<i>lahusenii</i> v. <i>punctatus</i>	x	x		x	x
<i>probabilis</i>	x	x	x	x	x
<i>prominens</i>	x	x	x	x	x
<i>quadrans</i>	x	x	x		x
<i>septus</i>	x	x	x	x	x
<i>simbirskianus</i>	x	x	x		x

PLATE SECTION

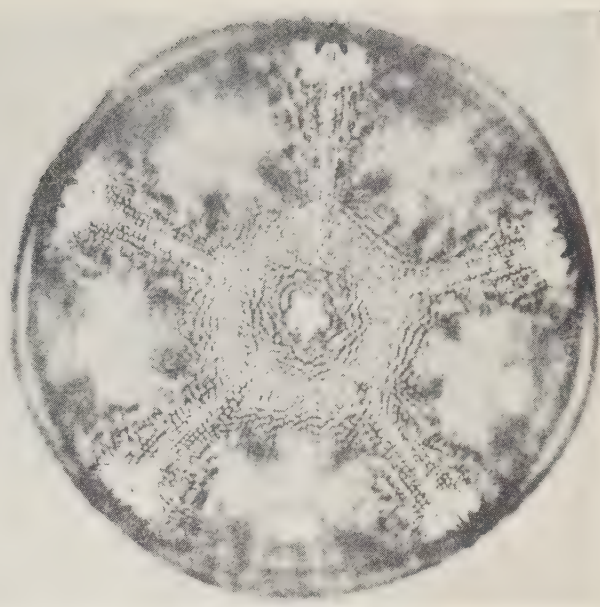
Photomicrographs by Warren E. Flint

Plate 1

1. *Aulacodiscus apedicellatus* Rattray
.125 mm. Ananino
2. *Aulacodiscus archangelskianus* Witt
.158 mm. Inza
3. *Aulacodiscus concinnus* Kitton ex Rattray
.108 mm. Ananino
4. *Aulacodiscus excavatus* Schmidt
.140 mm. Archangelsk-Kurojedowo



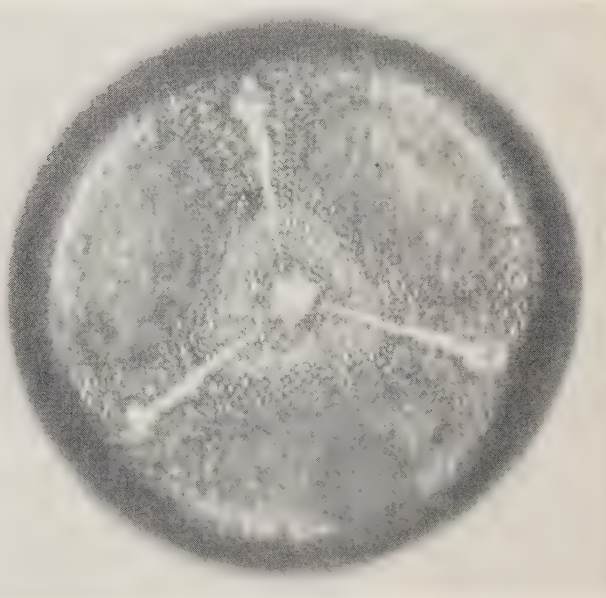
1



2



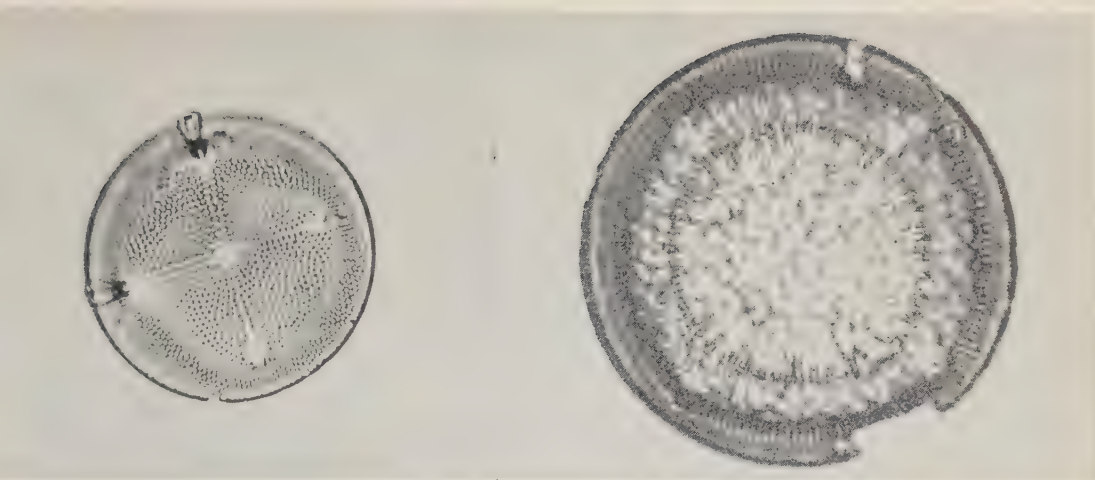
3



4

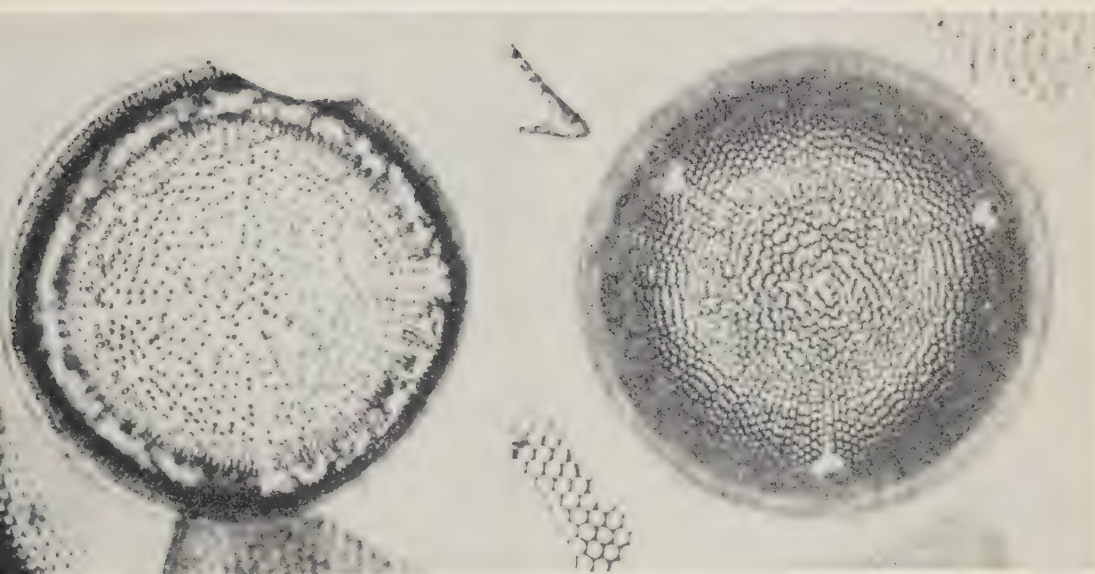
Plate 2

5. *Aulacodiscus glacialis* Grunow
.073 mm. Baryche
6. *Aulacodiscus lahusenii* v. *lahusenii* Witt
.100 mm. Inza
7. *Aulacodiscus lahusenii* v. *punctatus* Witt
.115 mm. Carlovo
8. *Aulacodiscus probabilis* Schmidt
.120 mm. Ananino



5

6



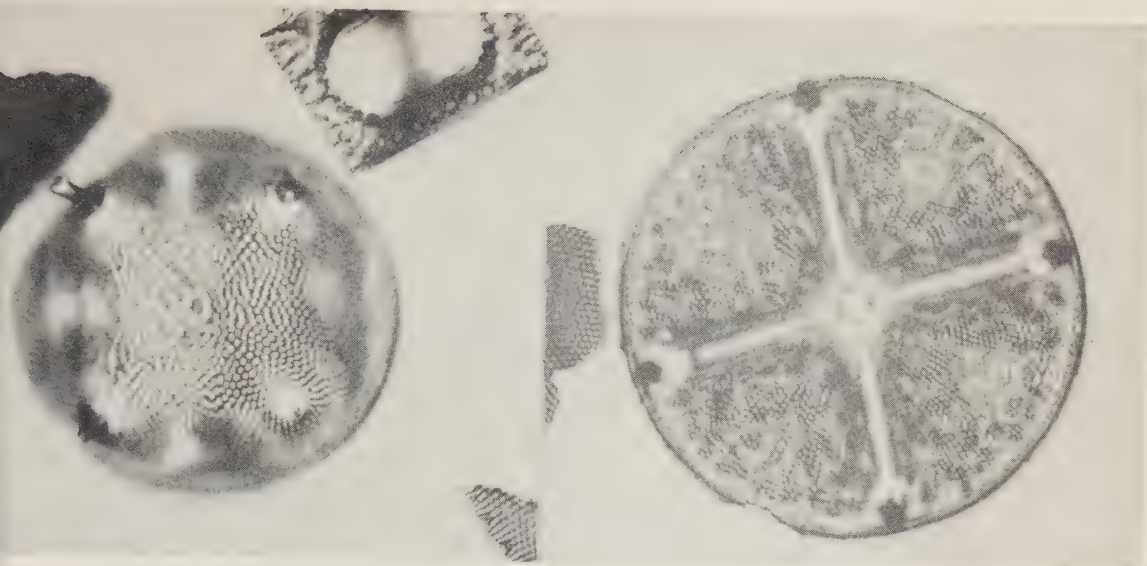
7

8

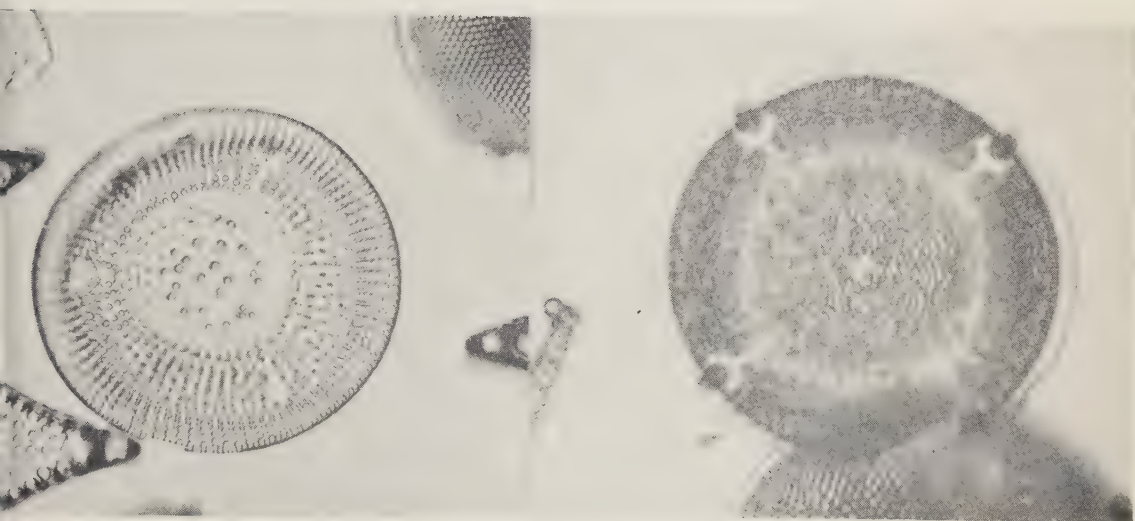
Plate 2

Plate 3

9. *Aulacodiscus prominens* Kitton ex Rattray
.100 mm. Baryche
10. *Aulacodiscus quadrans* Schmidt
.120 mm. Archangelsk-Kurojedowo
11. *Aulacodiscus septus* Schmidt
.090 mm. Baryche
12. *Aulacodiscus simbirskianus* Pantocsek
.105 mm. Archangelsk-Kurojedowo



10



12

The Black Widow Spider on Staten Island

by ARTHUR M. SHAPIRO

The public always needs something to worry about, and the press is usually more than willing to oblige with a scare. Nowadays mercury, lead, and cyclamates are in vogue. In 1934 it was black widow spiders. A few bites in California were blown up in the headlines until the Black Widow (*Latrodectus mactans* to arachnologists) became an overnight sensation. Newspapers staged black widow-tarantula "monster fights" and exterminators enjoyed an unexpected bonanza. All of this was brought to mind by the capture of a large female black widow on October 23, 1971 at the Fresh Kills landfill. It was the highlight of a Torrey Botanical Club outing, and the first widow most of the field-trippers had ever seen in New York City or anywhere else.

But it was far from the first ever collected on Staten Island. In fact, I took another fat female in Fox Hills in April of the same year, and have heard of collections in Concord and Stapleton. There are several records in the *Proceedings* of the Institute in the mid 1930's, when even sober naturalists suddenly became black widow conscious. It is even recorded (*Proceedings* 8: 25) that one was found behind the Staten Island Museum in 1934. None of this is surprising. The black widow is at home in litter-strewn, disturbed environments, particularly dumps, lumber yards, railroad yards, and along the waterfront. It occurs throughout the metropolitan area in such places, and is probably rather common though seldom reported; who, after all, turns over old boards and garbage? In its usual vacant lot habitat in South Camden, New Jersey, where I first met it years ago, the black widow is so common that anyone can find one, at least in spring; yet although children play constantly in its habitat, no bites have been reported. And few, if any, residents of the neighborhood have any idea that the spider is there.

Black widow bites have diminished in tandem with the decline of the old-fashioned outhouse. The black widow is a shy creature and shuns the light. It would often set up housekeeping under the rim of the seat. Any disturbance would elicit its usual response to potential prey in the web: a quick bite. The result was frequently a bite in a very embarrassing place on the human body. Infestations in privies, if anyone is still interested, are easily controlled by creosoting the underside of the seat. Infestations in other places seldom pose a threat to man; bites result only when human and spider are literally squeezed together.

The poison of the pea-sized female widow is probably, drop for drop, the most potent animal venom known. But the number of bites recorded and the fatality rate reflect the retiring habits of the spider and the small amount of venom usually injected. From 1726 to 1943 about 1,300 black widow bites were recorded in the United States, with 55 deaths—a mortality rate of about 4%. But this is an overestimate of the mortality, since some bites produce few or no symptoms and thus never find their way into medical records. A few deaths have been caused or speeded by improper treatment, ranging from administration of alcohol to unnecessary abdominal surgery when the symptoms were mistaken for peritonitis! Any black widow bite deserves medical attention, because the symptoms can be quite alarming. Pain begins locally but usually spreads to and centers in the abdomen and legs, and may be very intense. Other symptoms include nausea, vomiting, faintness, dizziness, loss of muscle tone, locomotor and speech disturbances, respiratory failure and shock. As is usual with poisoning, the very young, the old, and the chronically ill are most susceptible. Antivenin and symptomatic treatment are available. It is worth noting that more instances of venomous snake bite, and more deaths, occur every year in the U.S. than of black widow bites and deaths in 200 years; and that the probability of death by spider bite is lower than that of electrocution by lightning.

The male black widow does not bite. He is much smaller than the female, and usually more gaudily marked—often with yellow bands around the legs, and orange side-stripes on the abdomen. Contrary to popular mythology, he is no more likely to be devoured by the female after mating than the “average” male spider—which is to say, his fate depends on how recently she has eaten! Males may often be found living in the females’ webs, at least in the mating season (in New Jersey and presumably here, in September and again in April).

The black widow's brilliant coloration—quite unlike that of most spiders—is a good example of *warning coloration*; distasteful or poisonous animals frequently advertise their unpalatability to predators by being brightly colored, usually orange, red, or yellow and black. Wasps, bees, and the distasteful monarch butterfly are other common examples.

Female widows make satisfactory pets and may be kept in jars or terraria for several years if fed an insect or two weekly. Although they thrive in the company of man, they are rarely in his way and almost never a threat to his well being. They are merely one more interesting species in the Staten Island fauna.

Bibliography

- Gertsch, W.J. 1949. *American Spiders*. Van Nostrand, New York.
Thorp, R.W. and W.D. Woodson. 1945. *Black Widow*. University of North Carolina Press, Chapel Hill.

Bird Counts on Staten Island 1972

by MATHILDE P. WEINGARTNER

In 1972, the Christmas Bird Count was set back by one day to December 17 because the weather forecast was extremely inclement. This was the first time that this was done, and unfortunately it did not improve the lot of the observers. On the day of the count, the winds were very strong with gusts as high as 52 miles per hour.

The twenty-one birders who appeared in the field counted 71 species and 53,328 individuals.

At the beach, high winds had driven the tide out into the bay, preventing the high tide from coming in. The water was very rough and choppy, and as a result, the waterfowl rode into the troughs of waves making it very hard to see them for the count. Quite a few waterbirds were searching for protective coves. Ducks were found on land in their attempt to escape the rough water.

Over the land areas, few birds took to the air, and then only for short periods of time, because of the high winds. Their flight pattern differed from the usual, as the wind buffeted them, and this made identification often difficult.

The brown creeper, the wood duck, and the two thrashers were most likely still here because they had found food put out by people and also possibly because the day before had been quite mild. Ordinarily they should have moved south with other migrants by this date.

The most unusual find was that of the two glossy ibis. This pair came gliding in from over the Arthur Kill at the end of Victory Boulevard towards sunset to settle on the salt marsh for the night. Since the Kill is so badly polluted with oil, they would most likely not stay long. Food would be scarce for them, also.

The list:

Horned Grebe	55	Horned Lark	1
Great Blue Heron	3	Blue Jay	85
Black-crowned Night Heron	18	Common Crow	169
Glossy Ibis	2	Fish Crow	3
Canada Goose	4	Black-capped Chickadee	43
Mallard	233	Tufted Titmouse	15
Black Duck	1,226	White-breasted Nuthatch	7
Gadwall	3	Red-breasted Nuthatch	1
Green-winged Teal	8	Brown Creeper	1
Wood Duck	1	Mockingbird	25
Canvasback	9	Brown Thrasher	2
Greater Scaup	1,808	Robin	38
Goldeneye	213	Hermit Thrush	1
Bufflehead	593	Ruby-crowned Kinglet	1
Oldsquaw	72	Cedar Waxwing	24
Common Merganser	3	Starling	16,110
Red-tailed Hawk	9	Myrtle Warbler	15
Rough-legged Hawk	8	House Sparrow	490
Sparrow Hawk	6	Eastern Meadowlark	8
Ring-necked Pheasant	32	Red-winged Blackbird	178
Killdeer	20	Common Grackle	7
Ruddy Turnstone	23	Brown-headed Cowbird	44
Common Snipe	24	Cardinal	74
Greater Yellowlegs	5	Evening Grosbeak	5
Purple Sandpiper	27	Purple Finch	4
Dunlin	10	House Finch	55
Sanderling	2	Pine Siskin	1
Great Black-backed Gull	6,900	American Goldfinch	28
Herring Gull	23,040	Slate-colored Junco	85
Ring-billed Gull	116	Tree Sparrow	25
Bonaparte's Gull	901	Field Sparrow	1
Mourning Dove	204	White-throated Sparrow	110
Monk Parakeet	10	Fox Sparrow	16
Yellow-shafted Flicker	5	Swamp Sparrow	1
Hairy Woodpecker	3	Song Sparrow	37
Downy Woodpecker	22		

There was a high count on black ducks, bufflehead, and purple finches. Marsh hawks are usually seen on the Christmas Count, but none were counted this year.

The low count on scaup can be explained by the observers' difficulty with seeing the birds on choppy water. Sanderlings would find it hard to locate food since the seashore sands were partially frozen. Horned larks, swamp sparrows, and song sparrows would not fly up into the strong winds unless individuals are disturbed while feeding on the ground.

The observers were: Doris Barlow, Mary Benjaminson, Philip Benjaminson, Esther Brewer, Vincent Cardinale, Stanley Caufield, Howard Cleaves, Robert Clermont, Dean Chipman, Gloria Deppe,

Charles Fallon, Howard Fischer, Henry Flamm, Susan Kerber, Tom Materfis, Anna Meyer, Celia Polomany, John Stonick, Elsie Van Deusen, Mathilde Weingartner, Richard Zain-Eldeen. Seven members of the Section of Natural History took part in the Water-bird Count sponsored by the New York State Department of Environmental Conservation on Thursday, December 21, 1972.

Most of the ponds on the Island were visited as well as the seashore. The day was not too cold and the wind still. Nevertheless some of the ponds were thinly iced. In the open water on the ponds many fresh water ducks were seen; for example, the 89 mallards which were counted on Shore Acres Pond.

Missing from the count were the large rafts of scaup that usually float along off the South Shore. The count of black ducks was reduced by about one thousand from that taken at Christmas. Aside from these two species, the result was fairly normal.

Brant, which had been tallied as visitors to the Island over the past few years, were not seen this year. The reduction in their numbers may be due to a shortage of eel grass, which is their favorite food. This grass has been attacked by a disease recently.

The count of 160 canvasback ducks is very high for Staten Island. It is possible that the freeze-up on the Shrewsbury River with a resulting increased use of that area by ice-boaters had driven the birds from their favorite wintering spot into the open water of Raritan Bay.

The observers were: Charles Fallon, Howard Fischer, Henry Flamm, Vincent Cardinale, Anna Meyer, Max Richter, and Mathilde Weingartner.

Horned Grebe	11	Greater Scaup	815
Canada Goose	5	Goldeneye	303
Mallard	230	Bufflehead	382
Black Duck	220	Oldsquaw	30
Gadwall	3	Surf Scoter	1
Green-winged Teal	27	Common Merganser	3
American Widgeon	17	Red-breasted Merganser	1
Canvasback	160	<i>Total:</i>	2208

BOOK REVIEWS

"A Study of Bird Song" by Edward A. Armstrong. 68 illustrations.
A Dover Publication.

Dover Publishers have made available this revised and enlarged second edition of a book which was originally published in 1963 in Oxford, England. It includes some original work by Mr. Armstrong, but is essentially a compilation of the work of many other authors. It discusses birds found all over the world, but mostly the emphasis is on European species, and of these, the accent is on the British species. Many British birds have names similar to those of birds found in North America, but differ in species and genera, so that an unwary American birdwatcher may become confused by the book.

This revised edition was compiled because of the availability of new technology which makes it feasible to analyze bird song by spectrographic means and other electronic equipment. These techniques stress the great variety present in the songs of even one bird, changes which cannot be detected by the human ear. The author explains the reasons for this variety: bird song is a definite means of communication between bird pairs, families, species, genera, and even with other creatures in the environment.

Bird songs and utterances give clues as to the identity of the singing bird; the motivation for the song, such as defense of territory or alarm; and environment, such as the location of chicks by hens. The book describes the structure of bird song through pitch, intensity, quality, and continuity.

A young bird taken from its parents may develop an entirely different song from theirs since it is no longer able to hear them. Therefore one of the mechanisms for learning bird song is through mimicry of the parents.

There are dialects to be noted in bird song, which are generally related to geographic distribution; there are evolutionary changes. Incongruous songs such as the night song of daylight birds (killdeer, mockingbird, e.g.) are catalogued, as well as flight song as compared to the songs of perching birds. There are other methods than purely vocal ones with which some birds communicate with each other—woodpeckers and grouse come to mind.

The annual cycle of bird song is described in a chapter which covers the great differences that occur during the course of the year. It was not known that a great many female birds sing. This disclosure is of note in this book.

One question which is not answered is why some birds, notably the wood thrush, the brown thrasher, and the blue jay, can sing more than one note at a time.

This book can be recommended to those bird watchers especially interested in works bearing on the study of bird song. It is well indexed which is extremely helpful to the user.

—M.P.W.

"The Encyclopedia of Geochemistry and Environmental Sciences" edited by Rhodes W. Fairbridge, Professor, Columbia University, New York. Van Nostrand Reinhold Encyclopedia of Earth Sciences Series. \$49.50

This is the fourth of a remarkable series of modern, scientific encyclopedias and deals with the broad area of geochemistry and in addition includes the environmental sciences which are so prominently a part of present day concern. The over-all designation of the series is The Encyclopedia of Earth Sciences and the three earlier volumes dealt with Oceanography, Atmospheric Sciences and Astrogeology, and Geomorphology.

The present volume emphasizes the chemical treatment of the geological sciences, with detailed consideration of the various elements and minerals, including water in its various aspects.

The encyclopedic alphabetical arrangement leads to reference to any part of the volume where the interest of the moment may lie and having made this entry, the cross references and bibliographies lead to comprehensive treatment of the subject.

Historically this work is the godchild of Frank Wigglesworth Clarke's "Data of Geochemistry" that appeared in its several editions as Bulletins of the U.S. Geological Survey, starting in 1908 and extending to the fifth edition in 1924.

Physically this volume is unusual, octavo in size and weighing over five pounds; it is well printed on highly finished paper, and with a binding of the utmost flexibility permitting the book to lie open at almost any part of its 1321 pages.

—J.F.B.

"Pollution, Profits & Progress" by Henry A. Schroeder, M.D.
The Stephen Greene Press. \$4.95

Dr. Schroeder, founder and Director of The Trace Element Laboratory at Dartmouth, has been one of the most explicit and constant critics of our overly technologized civilization.

He has been a leading witness nationally against the effect of heavy metals on our environment, and has alerted us especially to the dangers of cadmium. In this slim book he increases our knowledge and understanding of the dangers of lead poisoning with statistics otherwise new to us. For example: we absorb about 10% of the lead we may eat but 50% of the lead we breathe (which is inadvertent). Up until 1924, lead was not present in gasoline but once added, as an anti-knock preparation and "to enable us to make jackrabbit starts," the average amount of lead in the bodies of American adults rose greatly. It was approximated at 121 mg by 1952. Lead accumulates in the body with age when exposures are high as is true of urban air today.

In a sense this is a handbook of basic facts which are briefly and clearly stated about pollution problems of our civilization. That these are related to profits is an incontrovertible fact to Dr. Schroeder who believes that certain pollutions will be contained, diminished, or discontinued only if the responsible industry and its lobby will allow it.

He believes in the increasingly broadening movement for "constructive sedition" as he terms it. This leads him to say hopefully, "The world may turn out better."

The book offers two appendices as chapters, one containing a personal "Glossary of Worries" and the other listing "The Metals Within Us." The latter is a useful roll call based on metals found in Reference Man (for which term read: Us), and divided into four categories: the first contains those 15 metals which are "Essential for Life." The second lists six innately toxic metals and the third lists those which are slightly toxic. The fourth summarizes trace metals found in Reference Man which are probably inert and ineffective. The amounts listed for Reference Man for all categories are in milligrams opposed to those amounts used in industrial consumption which are listed in thousands of tons.

A useful handbook for the environmentalist written in a clear, dry, and ironic style.

—G.K.S.

STATEN ISLAND INSTITUTE OF ARTS AND SCIENCES

1971-1972

OFFICERS

President Emeritus, Manuel J. Johnson
President, Terence H. Benbow
First Vice President, Thomas Schleier
Second Vice President, Bradford M. Greene
Treasurer, Leon Brown (To March 30, 1972)
David Colton (from April 17, 1972)
Secretary, George H. Maginley

BOARD OF TRUSTEES

A. M. Anderson	Robert M. Leng
Mrs. Charles E. Beyer	John H. Lotz
Ira Blei, Ph.D.	Mrs. Russell G. MacDonald
Daniel L. Bridgman	Louis R. Miller
Richard Buegler	Mrs. Horace P. Moulton
Joseph F. Burke	(deceased November 18, 1971)
Louis Cenci	Sanford Nalitt
Roy A. Cutter	Dr. Peter K. Nelson
Charles J. D'Arrigo	Mrs. Adolph Ostwald
Dean James L. G. FitzPatrick	Eldridge Peterson
Robert P. Hagenhofer	Hon. Royal S. Radin
Joseph J. Holzka	John S. Robotham
Robert L. Jacobson, D.D.S.	Benjamin A. Schabert
Dr. J. Trygve Jensen	David C. Smith
Herbert S. King, M.D.	Wesley E. Truesdell
Mrs. J. Joyce Klinger	John J. Turvey
Frank C. Krause	Manning W. Voorhees
Walter Kuhn	Joseph A. Weissglass

EX-OFFICIO MEMBERS

Hon. John V. Lindsay
Hon. Robert T. Connor
Hon. August Heckscher
Dr. Mary E. Meade
Prof. Arleigh B. Williamson
Maurice P. Wollin

DIRECTOR

George O. Pratt, Jr.

STAFF

Staten Island Museum: Elsie P. Verkuil, Assistant to the Director; Henry Korn, Administrative Coordinator; Jacqueline C. Louie, Membership Secretary; Elizabeth M. Marziale, Bookkeeper; Margaret Nichols (to November 5, 1971), Secretary; Frances M. Close (from February 2, 1972), Secretary. Eileen Pizzuto, Telephone Operator; Receptionists (Weekends): Roberta S. Butler (to May, 1972), Faith Hagenhofer (from June 1972), Lynn Marziale; Summer Interns: Peter Voorhees, Betsy Greene, Jonathan Benbow. Mathilde P. Weingartner, Curator of Science; Barry Leo Delaney, Curator of Art; Freda Esterly, Curator of Education; Gertrude Ferry, Educational Assistant; Gail K. Schneider, Editor/Librarian; Dorothy Kriete, Assistant Librarian (to October, 1971), Paul Trapp (from October, 1971) Assistant Librarian. Theresa Cenci, Manager of museum shop; Shop Assistants; Geraldine Cenci, Ingrid Kjeldaas, Betsy Greene. Carmine J. Taverna, Museum Maintainer; Carl C. Scacco, Senior Museum Attendant; Museum Attendants: John Fillinger, James Frasca, Peter A. Nieves, Charles R. Logan, Herbert Means.

Urban Corps Student-Interns: Elizabeth Antonelli, Valerie Buonantony, Ronald Cherner, Clifford Hanig, Susan Curino, Greg N. Dorr, Anne Deleonibus, Martin Dunn, Yvonne Fisher, Sue Higgins, Netta Kocurek, Kenneth Orbes, John Ray, Keith Rummer, Catherine Trapp, Sandra Vincent, Charles Andrew Warbington.

Student-Interns for "Black Man on Staten Island" Project at Port Richmond High School: Bernadette Anyanwu, Lula Boyland, Evelyn Clarke, Ben Greene, Julia Harrison, Dewey Livingston, Daniel E. Meaders, Parren Morris, Arnold Nelson, Robert Turner.

VOLUNTEERS

William T. Davis Wildlife Refuge Guides: Mrs. Philip Benjaminson, Charles Ackerman, Mrs. Oriente Calise, Mrs. Dolores Cummings, John Dreyer, Mrs. Anne Freeman, Mrs. Sigrid Kjeldaas, Mrs. George Haas, Mrs. George Murphy, Mrs. Stanley Polomany, Arthur Peters, Mrs. Philip Powles, Louis Raichle, Mrs. Hildegard Safford, Mrs. Pauline Schiff, Miss Elsie Van Deusen, Mrs. Joseph Von Bevern, Robert Wigand.

STAFF 1971-1972

High Rock Park Conservation Center: Elliot Willensky, Director; A. Mae Seeley, Assistant to the Director; Harry F. Betros, Associate Director for Educational Services; Ethel Z. Dicke, Coordinator for Program Services; Dominic Botta, Coordinator for Custodial Services; Helen Hauber, Coordinator for Administrative Services; Cynthia Jacobson, Coordinator for Higher Education; Elizabeth Seder, Coordinator for Informational Services; Office Staff: Charlotte Clegg, Florence Brown; Instructors: Mildred Becker, Rudolph Lindenfeld, Dorothy M. Aruny, Marie Burke, Gunda Halloran, Olivia Hansen; Guide/Instructors: Erna Gundlach, Ann Thomas Piecewicz, Mary Piraino; Guides: Thomas P. Boccellari, Marion Briggan, Maria Campo, Lucia Marie Corbo, Anne Marie Doolos, Wayne Edwards, Dorothy Fleming, Lucille Geary, Louise Halama, Evelyn Hare, Beulah Hauber, Frances I. Hennessey, George LaManna, Faith Mounier, Arthur Peters, Dorothy Quinlan, Mary Shea, Clayton Wollney; Visitors Center/High Rock Shop: Jean Raymond, Manager; Amy Clegg, Susan Quinlan; Custodial Services: Anthony Asaro, Michael Betros, Harold Brundage, Kenneth Lewis; Dorothy Quinlan, Librarian; Roberta Braisted, Audio-Visual Volunteer.

Annual Report of the Treasurer

1971/72

Receipts and expenditures of the Institute in the fiscal year ended June 30, 1972, are shown in the following summary:

RECEIPTS:

Interest and dividends	\$23,207.75
Dues from individual members	6,120.00
Other dues (organizations, etc.)	335.00
Museum and High Rock shops' profit	7,421.22
Contributions and miscellaneous	2,430.15
TOTAL RECEIPTS	\$39,514.12

EXPENDITURES:

Salaries and supplements to City-paid salaries	\$32,135.19
Other Museum and High Rock operating expenses	14,126.09
Publications	1,905.10
Davis Memorial Lectures	1,212.50
Miscellaneous	1,597.95
TOTAL EXPENDITURES	\$50,976.83

Additional gifts aggregating \$46,173.10 were received for specific purposes, and other funds were collected for special activities. These amounts and the expenditures therefrom are excluded from the above summary, as are gifts of objects for exhibit or other purposes.

At June 30, 1972 the private funds of the Institute were represented by the following:

Securities held by Institute	\$221,787.42
Securities held by F.N.C.B.	273,810.14
Cash held by Institute:	
Checking Account	50,105.69
Savings Accounts	59,408.46
Petty Cash	300.00
Cash held by F.N.C.B.	109,814.15
Museum and High Rock Shops' Inventory	3,455.31
Nominal Value of Equity in Museum Building—	2,866.76
Exhibitions & Fixtures	1,000.00
Less Payroll Tax Withholdings	3,921.11
TOTAL	\$608,812.67

The City supplemented the above figures with an appropriation under the 1971/72 annual budget of \$249,810. This was used for salaries and maintenance of the Museum, High Rock Park Conservation Center and the William T. Davis Wildlife Refuge in the following ways: Executive Management \$72,150; Curatorial and Instructional \$55,012; Expert Services \$2,000; Building Maintenance and Protection \$78,135; Office Supplies and Utilities \$42,413.

The New York State Council on the Arts made a Grant of \$30,000 to the Museum for strengthening the Administrative staff.

David Colton
Treasurer

STATEN ISLAND INSTITUTE OF ARTS AND SCIENCES

1972-1973

OFFICERS

President Emeritus, Manual J. Johnson
President, Terence H. Benbow
First Vice President, Thomas Schleier
Second Vice President, Bradford M. Greene
Treasurer, David Colton
Secretary, Mrs. Russell G. Macdonald

BOARD OF TRUSTEES

A. M. Anderson, P.E.	Robert M. Leng
Mrs. Charles E. Beyer	John H. Lotz
Ira Blei, Ph.D.	George H. Maginley
Daniel L. Bridgman	Louis R. Miller
Richard Buegler	Horace P. Moulton
Joseph F. Burke	Sanford Nalitt
Louis Cenci	Dr. Peter K. Nelson
Roy A. Cutter	Mrs. Adolph Ostwald
Charles J. D'Arrigo	Eldridge Peterson
Dean James L. G. FitzPatrick	Hon. Royal S. Radin
Robert P. Hagenhofer	John S. Robotham
Dr. J. Trygve Jensen (to 4/73)	Benjamin A. Schabert
Mrs. Martin L. Johnson	David C. Smith
Mrs. J. Joyce Klinger	Wesley E. Truesdell
Frank C. Krause (to 4/73)	John J. Turvey
Walter Kuhn	Manning W. Voorhees
Joseph A. Weissglass (deceased 5/1/73)	

EX-OFFICIO MEMBERS

Hon. John V. Lindsay
Hon. Robert T. Connor
Hon. August Heckscher (to 12/72)
Hon. Richard Clurman (from 1/73)
James Regan
Prof. Arleigh B. Williamson
Maurice P. Wollin

DIRECTOR

George O. Pratt, Jr.

STAFF

Staten Island Museum: Elsie P. Verkuil, Assistant to the Director; Henry Korn, Administrative Coordinator; Jacqueline C. Louie, Membership Secretary; Elizabeth M. Marziale, Bookkeeper; Susan A. Mallen, Assistant Bookkeeper (from 2/73); Frances M. Close, Secretary; Eileen Pizzuto, Telephone Operator; Week-end Receptionists: Lynn Marziale, Faith Hagenhofer. Mathilde P. Weingartner, Curator of Science; Barry Leo Delaney, Curator of Art; Freda Esterly, Curator of Education; Gertrude Ferry, Education Assistant; Gail K. Schneider, Editor/Librarian; Paul Trapp, Assistant Librarian; Hugh Powell, Research Associate. Theresa Cenci, Manager of museum shop; Shop Assistants: Geraldine Cenci, Ingrid Kjeldaas, Betsy Greene (to 8/72) Mary Lou Snyder (from 9/72). Carmine J. Taverna, Museum Maintainer; Carl C. Scacco, Senior Museum Attendant; Museum Attendants: John Fillinger (to 10/72), John Santiago, from 10/72), James Frasca, Peter A. Nieves, Charles R. Logan, Herbert Means (retired 1/73), Angelo Tardogna (from 1/73), Robert Taverna.

Urban Corps Student-Interns: Sharon Broyde, Brenda Faust, Julia Harrison, Susan Higgins, Joseph Kirdahy, David Lohman, Polly McLean, Ann Marie Meehan, Theodore Merwin, Alex Procho, Edward J. Ryan, Catherine Trapp, Sandra Vincent, Leith Zerilli.

VOLUNTEERS

William T. Davis Wildlife Refuge Guides: Charles Ackerman, Mrs. Philip Benjaminson, Mrs. Oriente Calise, Mrs. Dolores Cummins, John Dreyer, Mrs. Anne Freeman, Mrs. Sigrid Kjeldaas, Mrs. George Haas, Mrs. George Murphy, Mrs. Stanley Polomany, Mrs. Philip Powles, Louis Raichle, Mrs. Hildegard Von Bevern, Robert Wigand, Jordan Bommersheim, Mrs. Lynette Danskin, Frank Lella.

Hosts and Hostesses for the Duration of the "1, 2, 3" Show at Sailors' Snug Harbor: Mrs. Cecil Bell, Mr. and Mrs. Frederick Berstell, Robert E. Burakiewicz, Mrs. William Calise, Miss Jane Forrest, Mrs. Howard Hill, Mrs. Grace Jenkins, Mrs. Terje Kjeldaas, Mr. and Mrs. Alexander Levy, Mrs. George Murphy, Miss Irene Reuter, Mrs. Albert Ricca, Mrs. Ferdinand Salvatore, Mrs. Frederick Schlobohm, Mrs. Edythe W. Scott, Mrs. Anna Claire Sims, Mrs. Maria Stigi, Mr. and Mrs. Alfred Williams.

Junior Hosts and Hostesses, Opening of "1, 2, 3" Show: Wendy Ahlin, Larry Furman, Kim Louie, Andrew Louie, Lynn Marziale, Mary Lou Snyder, Angela Taverna, Cary Taverna, Susan Telowitz.

STAFF 1972-1973

High Rock Park Conservation Center: Elliot Willensky, Director; A. Mae Seeley, Assistant to the Director; Harry F. Betros, Associate Director for Educational Services; Ethel Z. Dicke, Coordinator for Program Services; Dominic Botta, Coordinator for Custodial Services; Helen Hauber, Coordinator for Administrative Services; Cynthia Jacobson, Coordinator for Higher Education; Office Staff: Charlotte Clegg, Florence Brown; Instructors: Mildred Becker, Rudolph Lindenfeld, Dorothy Aruny, Marie Burke, Gunda Halloran, Olivia Hansen; Guide/Instructors: Erna Gundlach, Mary Piraino; Guides: Thomas Boccellari, Marion Briggin, Maria Campo, Lucia Marie Corbo, Anne Marie Doolos, Wayne Edwards, Dorothy Fleming, Lucille Geary, Louise Halama, Evelyn Hare, Allen Hauber, Beulah Hauber, Frances I. Hennessey, Barbara Hosie, George LaManna, Irene Mahler, Faith Mounier, Arthur Peters, Dorothy Quinlan, James Rossi, Mary Shea, Clayton Wollney; Visitors Center/High Rock Shop: Jean Raymond, Manager; Amy Clegg, Lynn Hauber, Patti Hauber, Susan Quinlan, Janyce Woll; Custodial Services: Michael Betros, Harold Brundage, Edward Hansen, George LaManna, Raymond Matarazzo, James Rossi; Librarian: Dorothy Quinlan; Audio-Visual Volunteer: Roberta Braisted; Executive Interns: Thomas Bilotti, Debi Charette; Urban Corps: Robert Cavalli, Paul Cooper, Helen Eckelman.

Receipts and expenditures of the Institute in the fiscal year ended June 30, 1973, are shown in the following summary:

RECEIPTS:

Interest and dividends	\$25,328.36
Dues from individual members	5,760.00
Other dues (organizations, etc.)	240.00
Museum and High Rock Shops' profit	7,656.54
Contributions and miscellaneous*	29,754.00
TOTAL RECEIPTS	\$68,738.90

EXPENDITURES:

Salaries and supplements to City-paid salaries	\$38,512.94
Other Museum and High Rock operating expenses	19,985.06
Publications	4,808.76
Davis Memorial Lectures	1,164.72
Miscellaneous	1,449.35
TOTAL EXPENDITURES	\$65,920.83

Additional gifts aggregating \$33,187.93 were received for specific purposes, and other funds were collected for special activities. These amounts and expenditures are excluded from the above summary, as are gifts of objects for exhibit or other purposes.

At June 30, 1973 the private funds of the Institute were represented by the following:

Securities held by the Institute	\$221,787.42
Securities held by F.N.C.B.	273,810.14
Checking accounts and cash held by F.N.C.B.	15,146.14
Savings accounts	58,872.61
Petty Cash	500.00
Museum and High Rock Shops' Inventory	3,960.29
Nominal Value of Equity in Museum Building—	
Exhibitions & Fixtures	1,000.00
Less Payroll Tax Withholdings	1,245.04
TOTAL	\$573,931.56

* This figure includes \$13,299 for the Director of High Rock Fund.

The City supplemented the above figures with an appropriation under the 1972/73 budget of \$268,585. This was used for the administration and maintenance of the Museum, High Rock Park Conservation Center and the William T. Davis Wildlife Refuge in the following ways: Executive Management \$85,725; Curatorial and Instructional \$59,999; Expert Services \$2,000; Building Maintenance and Protection \$81,161; Office Supplies and Utilities \$39,780.

The New York State Council on the Arts made a Grant of \$25,000 to the Museum for strengthening the Administrative staff and \$13,000 to offset a budget deficit for the Museum and High Rock.

David Colton
Treasurer

ABOUT OUR CONTRIBUTORS

Joseph F. Burke and *Warren E. Flint* have devoted many years to the study of diatoms. Both are members of the New York Microscopical Society and both are past-presidents. Their business backgrounds have been finance and precision instrumentation respectively.

Arthur M. Shapiro, now Assistant Professor, Zoology Department, at the University of California, Davis Campus, had been Assistant Professor of Biology at Richmond College. During his brief stay on Staten Island, the Institute was pleased to publish his articles in the PROCEEDINGS. He is author and illustrator of "New York City's Last Frontier: Field Trips on Staten Island," which the Institute published in the Spring of 1973.

Mathilde P. Weingartner is Curator of Science for the Staten Island Museum as well as Curator of the William T. Davis Wildlife Refuge. She has been the author of many articles printed in previous PROCEEDINGS and in other scientific publications. She is the author of "The Staten Island Walk Book."

GIFTS AND BEQUESTS

The core of The Staten Island Institute, its collections and library, their care and their use, are all supported by private funds. The quality of the Institute's performance is directly determined by the nature and extent of individual gifts.

To encourage such support, The State of New York and The United States Government permit deductions on the donor's income tax returns for gifts of cash, securities, land or objects of art accepted by the Institute and its Museum.

In view of the complexities of the tax laws, the Director is happy to discuss with any donor or his advisors ways to accomplish these objectives. He is also willing to suggest specific memorials within the Institute to preserve the donor's name or to honor members of his family.

A

- Armstrong, Edward A., author
75
"Aulacodiscus Species of the
Simbirsk Flora," by J. F.
Burke and W. E. Flint (arti-
cle) 59-67

B

- "Bird Counts on Staten Island,
1972," by M. P. Weingartner
(article) 72-74
"Black Man on Staten Island"
Project Student-Interns 79
"Black Widow Spider on Staten
Island," by A. M. Shapiro
(article) 69-71
Burke, Joseph F. 88; article
by 29; book review by 76

C

- Christmas Bird Count, 1972
72-73

D

- Davis Wildlife Refuge Guides
79, 84
diatoms: Aulacodiscus 59

E

- "Encyclopedia of Geochemistry
and Environmental Science"
edited by Rhodes W. Fair-
bridge; reviewed by J. F.
Burke 76

F

- Fairbridge, Rhodes W., editor
76
Flint, Warren E. 88; photo-
micrographs by 61; article
59

H

- High Rock Park Conservation
Center Staff, 1971/2 80; 1972
/3 85

L

- Latrodectus mactans* 69

O

- Observers on bird counts, 1972
73, 74

P

- "Pollution, Profit & Progress,"
by Henry A. Schroeder, re-
viewed by G. K. Schneider
76

S

- Schroeder, Henry A., author
76
Shapiro, Arthur M. 88; article
by 69
Simbirsk, U.S.S.R., flora 59
spiders: Black widow (*Latro-
dictus mactans*) 69-71
Staten Island Institute of Arts
and Sciences; Officers, Trus-

tees, Staff; 1971/2	78-80;	U
1972/3	83-85	U.S.S.R. diatoms 59
Treasurer's Reports	1971/2	Urban Corps Student-Interns
81; 1972/3	86	79, 84
Staten Island Museum: Staff		W
79, 84		Waterbird Count, 1972 74
"Study of Bird Song, A" by E.		Weingartner, Mathilde P. 88;
A. Armstrong, reviewed by M.		article by 72; review by
P. Weingartner	75	75



